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Original Communications

CARBOHYDRATE METABOLISM DURING PREGNANCY AND THE VALUE OF INSULIN TO THE OBSTETRICIAN*

BY HUGO EHRENFEST, M.D., F.A.C.S., ST. LOUIS, MO.

AS early as 1895, v. Jaksch and also Lanz had ascertained that pregnant women are likely to respond with a glycosuria to the intake of 100 grams of glucose, and already Lanz had spoken of the possible usefulness of this phenomenon in the diagnosis of pregnancy. These findings were fully confirmed by Hofbauer, in 1899. Though again carefully studied by Stolper, Payer, Reichenstein and others between 1909 and 1911, this problem actually did not attain its present general interest among obstetricians until Frank and Nothmann published their first paper on this subject in 1920.[1] They explained the almost typical appearance of a glycosuria, especially early in pregnancy, after a dose of 100 grams of glucose on a fasting stomach on the basis of a renal diabetes. Kamnitzer and Joseph[2] changed this diagnostic test, seemingly without impairment of its value, by giving 75 grams of rice with 100 grams of cane sugar. They also ascertained a markedly increased tendency of pregnant women to develop a phlorizin glycosuria. Brinitzer[3] confirmed earlier observations of Christofoletti and of Ryser concerning the fact that adrenalin during pregnancy will cause a glycosuria when given in a dose which, as a rule, proves too small to yield this same effect in a nonpregnant woman, a fact fully confirmed by Jaeger.[4] On these findings Roubitschek[5] based his pregnancy test: one-half c.c. of a 1:1000 adrenalin solution, followed by 10 grams of dextrose given in 250 grams of tea. Kuestner[6, 7] thought that some of the failures with the Roubitschek test might be

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

due to the inability of the injected adrenalin to stimulate glycogenolysis, if the preceding starvation had greatly reduced the glycogen contents of the liver. He, therefore, suggested the following modification: Not too long after the last meal, 10 grams of dextrose are given in 200 c.c. of water or tea, and only 15 to 20 minutes later 0.5 mg. of adrenalin is injected. Since he saw a glycosuria appear with a blood sugar concentration as low as 0.082, and at an average level of 0.141, he agrees with Frank's contention[8] that this pregnancy phenomenon can be explained solely as a renal diabetes, to which Hofbauer[9] agrees.

The validity of this explanation, however, has been doubted by other investigators. The glycosuria thus artificially produced, as a matter of fact, is always preceded by a hyperglycemia. Frank stresses the point that this hyperglycemia never transgresses the 0.2 point. Bauer[10] in 200 cases noted a rise from about 0.08 to about 0.2, and Zondek[11] actually discarded the Frank-Nothmann test for the very reason that he observed an occasional rise above 0.19. Frank's claim that this test reveals an abnormal permeability of the kidney for sugar during pregnancy, i.e., a physiologic condition identical with renal diabetes, is based on his assumption that the normal renal threshold is 0.19. Rather generally it is now believed that considerable variations exist in this respect in normal healthy individuals, but the normal renal threshold is placed, e.g., by Macleod[12] at a blood sugar concentration of 0.17. For this reason of late more often this peculiar phenomenon of pregnancy is referred to as an alimentary hyperglycemia and glycosuria *e saccharo*. However, as emphasized by Dietrich[13] even this is not entirely correct since already Novak, Porges and Strisower[14] had demonstrated that pregnant women are likely to develop also an alimentary glycosuria *ex amylo*, which according to the investigations of Eisner and Fortner it is impossible to produce in a nonpregnant, nondiabetic woman.

We, therefore, must conclude that it is not justifiable to speak of this peculiar and fairly common derangement in the carbohydrate metabolism of pregnant women either as a renal diabetes or as an alimentary glycosuria within the usual clinical meaning of either term.

Before I offer my own explanation of this condition, I wish to emphasize that this anomaly is not discovered in every pregnant woman or in all stages of pregnancy of the same individual, and that the various tests here mentioned are not by any means absolutely reliable. The outcome of such a test, however, rather generally is considered as excluding the diagnosis of pregnancy whenever it fails to produce a glycosuria. It is well known that a positive result with the test may be dependent upon various other conditions outside of pregnancy. Nuernberger,[15] e.g., finds the Frank-Nothmann test very valuable, as does Nothmann[16] in a summary of all results so far recorded in literature. Jensen[17] considers it of some value, Seitz[18] as too unreliable.

Kamnitzer and Joseph[19] object to the adrenalin test on account of its disagreeable effect on the patient. Their own phlorizin test yielded satisfactory results in the hands of Leskinen[20] but proved disappointing to Long and Hirst.[21] Hellmuth[22] found all the tests unsatisfactory, as does Williams,[23] while on the other hand they prove a valuable diagnostic aid in the experience of Welz.[24] We find many writers recommending the phlorizin test, e.g., Burger,[25] Houet, Pouget and Milochevitsch,[26] Koster,[27] Lewin,[28] Sacharoff,[29] Scheffel,[30] Schilling and Goebel,[31] or Zondek,[11] though, e.g., Hollingworth[32] and others find it but little dependable. Interesting is the suggestion of Lembke and Lindig[33] that discrepancies in the results of the same test in the experience of different observers might be due to racial differences among patients of various countries.

This widespread interest in the diagnostic value of an artificial glycosuria has during the past three years yielded information which, in my belief, greatly advances our understanding of carbohydrate metabolism and its physiologic alterations during pregnancy.

In the attempt to present here this newer knowledge I shall speak first of morphologic and functional changes which in the course of pregnancy occur in organs that control sugar metabolism, namely, the liver, the various endocrines and the vegetative nervous system. On the basis of these changes I shall endeavor to explain the problem of the maintenance within normal limits of blood sugar concentration in the pregnant woman and the evident alteration during pregnancy of the level at which under certain conditions sugar is permitted to flow over into the urine.

LIVER

In spite of much adverse evidence the idea of typical changes in the liver tissue during pregnancy, based chiefly on the pioneer work of Hofbauer, is still prevalent. The term, "liver of pregnancy," expressing a definite analogy to the "kidney of pregnancy," is freely employed in obstetric literature.

In the light of present information, however, much of the evidence accepted by older investigators as conclusive for a reduced glycogenetic ability, today is almost valueless. Indeed, the investigations of Staub and Rosenberg have established that one large dose of sugar, formerly considered the best test in ascertaining liver function, stimulates the liver cells and thus actually eliminates any possibility of differentiating with it between an insufficient and a normal hepatic function.

Isaacs had shown that levulose might be more usefully employed as a functional liver test. Gottschalk and Strecker[34, 35] discovered that a dose of only 100 gr. of levulose, insufficient to cause a glycosuria in a nonpregnant woman, will in a large percentage of pregnant

women lead to a hyperglycemia and glycosuria. This proved in their belief a physiologic impairment of hepatic function during pregnancy. Similar observations were recorded by Jaeger[4] and others, and also by Hetenyi and Lieberman.[36] These last mentioned two investigators, however, pointed out the obvious fact that while possibly acceptable as proof of liver deficiency in man or the nonpregnant woman, the positive outcome of the levulose test is deprived of all its significance in pregnant women because in them very often the kidney becomes markedly more permeable for all sugars. In comparative experiments they found that normally the renal filter proves less dense for levulose than glucose.

Widal's test of hemoclastic crisis, a symptom complex characterized chiefly by a leucopenia following the intake of 200 gr. of milk, was employed to test liver function during pregnancy. Kaboth[37] found that a positive reaction occurs decidedly more often in pregnant than in nonpregnant women. It is invariably positive in cases of marked toxicosis and especially of eclampsia. All we, therefore, can say is that during pregnancy at least the proteopexic function of the liver is impaired in many women, of course granted that this test of Widal really is a true indicator of impaired hepatic activity, which is denied by some authors. In the investigations of Powilewicz (quoted by Vignes[38]) the test was negative in less than half of all pregnant women, a figure practically identical with that ascertained by Nuernberger.[39] Didier and Philippe[40] found the positive tests percentually to increase the further pregnancy is advanced. This alimentary leucopenia, in my opinion, at least proves a fairly common dysfunction of metabolism and of the vegetative nervous system during pregnancy, a fact not without its significance in the problem here discussed.

Reports from various investigators (Williams,[41] Rosenfield and Schneiders[42] and others) show that liver function, as expressed in the outcome of the phenoltetrachlorphthalein test, seems approximately normal in healthy pregnant women, but apparently is impaired in the presence of toxic complications.

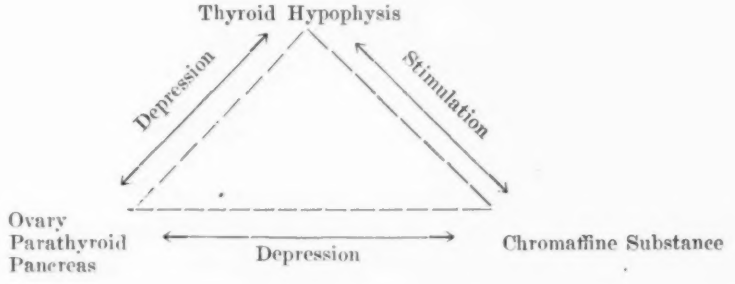
Wesselow,[43] in a most exhaustive study of the question, arrives at the conclusion that we seemingly do not possess a definite and reliable method of testing hepatic function. Even a combination of various methods of study, in the opinion of Hetenyi and Lieberman[36] fails to furnish convincing proof of a physiologic hepatic insufficiency during pregnancy, and Schickele[44] asserts that the conception of a "liver of pregnancy" cannot be definitely described in histopathologic terms.

I must emphasize that these last quoted authorities are referring only to the absence of physiologic changes but do not deny liver derangement in the presence of toxic conditions, which are fairly common in pregnancy. At least for them we might assume, though the fact has never been convincingly established, that morphologic altera-

tions could account for impaired function of the organ also within the carbohydrate metabolization process.

ENDOCRINES

It will be advantageous to reproduce here the well-known diagram of Aschner which so clearly indicates both the stimulating and depressing influences exerted by the various endocrines on each other in their relation to carbohydrate metabolization.



(a) *Thyroid.*—As indicated in this diagram the thyroid stimulates the adrenals but depresses pancreatic function. More recently this has been clearly shown in the results of the studies of Olmstead and Gay.[45] "Increased thyroid activity leads to increased metabolism, and to a delay in glycogenesis or augmented glycogenolysis."

What do we know concerning thyroid changes in pregnancy?

Various observers have recorded a palpable enlargement of the thyroid in about 75 to 80 per cent of all pregnant women. This high percentage of enlargement can be interpreted only as response to a specific need for thyroid output made by pregnancy. Engelhorn in exact histologic investigations has shown that both in animals and the human, during pregnancy hypertrophic and hyperplastic changes with increased colloid formation can be demonstrated. Also certain clinical observations support the idea that during gestation an increased supply of thyroid hormones is essential. Patients with evidently defective thyroids, suffering from cretinism, myxedema or cachexia strumipriva, are noticeably harmed by an intervening pregnancy. On the other hand, hyperthyreotic patients, cases of Basedow not severe enough to have led to amenorrhea and sterility, according to French writers and in the experience of Kocher, almost as a rule, are temporarily benefited by pregnancy.

An increased thyroid function, therefore, can be accepted as an established physiologic phenomenon of pregnancy.

(b) *Parathyroids.*—Within the process of carbohydrate metabolism the parathyroids act in the same sense as the pancreas. This fact is firmly supported by the experiments of Underhill and Blatherwick.[46]

Removal of the parathyroids causes glycosuria and reduces the assimilation limit for carbohydrate.

There is evidence available to show that pregnancy demands an increased supply of parathyroid hormones and that insufficiency of these glands is responsible for the development of tetany. Animals from whom a part of the parathyroid tissue has been removed exhibit the typical signs of tetany when becoming pregnant, as shown by Vassale, Erdheim,[47] Adler and Thaler.[48] Several instances have been recorded of the appearance of tetany in pregnant women on whom a strumectomy had been performed, presumably with incidental injury to the parathyroids. They all recovered promptly after labor.

We, therefore, know that in some women parathyroid function during pregnancy becomes markedly deficient but at present we have no evidence that this factor actually plays a rôle in the anomalies of carbohydrate metabolism during pregnancy.

(c) *Adrenals.*—The importance of the adrenals in the process of sugar metabolization is so well known that I can limit myself to but a few quotations from Macleod. Epinephrin acts on glands and muscles in the same manner as does stimulation of their sympathetic nerve supply. This is most pronounced in its effect on metabolism. Injection of epinephrin excites glycogenolysis in the liver and thus leads to hyperglycemia and glycosuria.

In many ways increased sensitiveness of the pregnant woman to adrenalin has been demonstrated. The often mentioned view, however, of a physiologic adrenalinemia of pregnancy certainly is not based on conclusive proof. Of greater value in this respect might be the claim of Sestini (quoted by Vignes), so far neither confirmed nor disproved, that a distinct adrenalinuria appears in the fourth month of pregnancy which gradually increases up to term. He asserts that there exists an evident parallelism between the amount of adrenalin in the urine and the degree of pigmentation of the patient's skin.

Mention already has been made of the fact that a marked susceptibility of pregnant women to adrenalin forms the basis of some of the tests devised to aid in the diagnosis of early pregnancy by the production of an artificial glycosuria. Noteworthy in this connection are the experiments of Deluca.[49] He found that after the injection of pilocarpin or of the extracts of adrenal, thyroid, pituitary or ovaries, the rise in the blood sugar was most pronounced subsequent to the injection of adrenalin. This substance, in his opinion, necessarily proved most potent because of its specific effect on the mobilization of glycogen stored in the liver.

Summarizing all available information, we are justified in deducing that the adrenals probably of all pregnant women are in a state of hyperactivity. Considering in particular the well established fact, that even a small dose of epinephrin, especially with the addition of

but 10 grams of glucose, causes a glycosuria in so large a percentage of pregnant women (97 per cent according to Kuestner[7]) we may conclude that the adrenals play a very important rôle in the seemingly lowered sugar tolerance of pregnancy. The condition is apparent in the very earliest stages of pregnancy and no other organ participating in carbohydrate metabolism is likely to react so very promptly to the change of conditions brought on by impregnation. That the adrenals react almost instantaneously is amply proved by the immediate appearance of a glycosuria after a sudden and profound emotion. That this glycosuria is the result of a prompt output of adrenalin is definitely established by the fact that it fails to appear if the adrenals have been removed (Bauer[50]).

(d) *Ovaries.*—Though a great number of different extracts obtained from ovarian tissue have been extensively studied, ideas concerning their physiologic action today probably are more obscure than ever before. The very use of the terms hyperfunction or hypofunction in regard to the ovaries is scientifically incorrect, because the ovary undeniably produces various hormones, very different in their action, any one of which, in certain phases of ovarian activity, might be—completely or only partially—present or absent. Fellner,[51] e.g., claims to have isolated three biologically differing substances of which at least one, in animal experiments, manifests the striking ability of preventing a typical adrenalin glycosuria. Since in pancreatectomized animals this particular hormone failed to reduce the hyperglycemia, he concluded that this ovarian substance simply acts as a stimulant of pancreatic endocrine function. Wuerzler[52] fully confirmed former experiments of Baillod on rabbits, which show that after removal of all ovarian tissue these animals prove particularly sensitive to many of the known stimuli which cause a rise of blood sugar. He also ascertained this same sensitiveness in castrated women, an observation previously recorded by Guggisberg[53] and probably first thoroughly studied by Stolper.[54, 55]

It will be of no advantage to cite here other experiments and clinical observations demonstrating a relation of ovarian function to carbohydrate metabolism. They have mostly been made by obstetricians and might not be absolutely convincing to the physiologist. However, I must refer more in detail at least to the experiments of Kuestner[56, 57] since they bear more directly on the problem I am discussing now, viz., the rôle possibly played by the ovaries in the seeming lowering of sugar tolerance during pregnancy.

Kuestner ascertained that in pregnant rabbits, beginning from the first day after copulation, a glycosuria will be caused by the introduction—through a stomach tube—of a certain amount of glucose which has failed to produce this symptom in the same animal before impregnation. Female rabbits in this respect apparently react exactly

like woman. The cause for this impaired faculty of sugar assimilation could arise only either from the uterus and its contents (fetus and placenta) or from the ovaries. He, therefore, made another series of experiments. He determined exactly the sugar tolerance of each of a number of female rabbits. On the tenth day after impregnation he operated on them. In one-half of the number he removed the uterus and its contents, in the other half he removed only all ovarian tissue. On the second day after operation the castrated animals showed return of their sugar tolerance to normal, while in the hysterectomized animals the lowered tolerance continued up to the fifth day. This proved clearly that the ovaries and not the uterus, fetus or placenta supplied the substance responsible for the lowering of tolerance. He added, however, further evidence for his contention by showing that transplantation of the ovaries removed from the pregnant animals into other nonpregnant rabbits, proved beforehand not to be diabetic, that such a transplantation caused nonpregnant rabbits to react to a glucose intake exactly like pregnant animals. Since he had previously ascertained that this same condition of reduced assimilation power for one dose of sugar can also be demonstrated in seemingly healthy women just before the appearance of the menstrual flow, Kuestner seems justified in his conclusion that the factor which thus disturbs sugar metabolization is supplied by the corpus luteum.

A question naturally suggests itself in this connection. Are these findings of Kuestner that the corpus luteum furnishes the disturbing element not in direct opposition to experiments which tend to show that the removal of all ovarian tissue leads to this same tendency of an alimentary glycosuria? Only seemingly so. A glycosuria follows the injection of extracts of certain endocrines as well as the extirpation of others. Some hormones stimulate, others retard sugar metabolization. The ovary, as already pointed out, unquestionably produces various hormones; they may well be as antagonistic in their influence on carbohydrate metabolism as they apparently are in other respects.

Even with the question of the exact mechanism of ovarian influence still unsettled, Kuestner's work clearly establishes the fact that during pregnancy the ovaries impair the animal's ability to assimilate properly one large dose of sugar.

This reduced ability, expressed in a hyperglycemia and a glycosuria, manifests itself early in pregnancy and also just before the appearance of the menstrual flow, as confirmed by other observers. This fact must be emphasized, because its evidently general disregard by clinicians might well be responsible for serious error in the interpretation of the results of a glucose tolerance test, when made on a woman without proper consideration of the time of her last menstruation.

(e) *Pituitary.*—A physiologic increase in the size of the anterior

lobe of the pituitary during pregnancy has been first mentioned by French and Italian writers and has been later fully confirmed by the thorough histologic studies of Erdheim and Stumme,[58] and also of Kolde,[59] who both in animals and the human found a typical, large increase of the chromophobe main cells, which on account of their individual morphologic alteration, in German literature now commonly are spoken of as "pregnancy cells." Enlargements of the hypophysis, up to three times of normal size, have been reported especially in multiparous women. The changes occurring with each succeeding pregnancy are so pronounced that according to Oskar Frankl, the experienced pathologist will be able at necropsy to diagnose the parity of the woman from the size of the pituitary. Exaggeration of this physiologic enlargement occasionally is responsible for a bilateral hemianopsia, the result of pressure against the chiasma. Very recently Loehlein[60] has recorded the noteworthy observation that in about 80 per cent of all advanced pregnancies a lateral narrowing of the visual field, especially for red and green, can be ascertained. Since the field again is found normal 10 days postpartum, the relation of this alteration of the visual field to pressure exerted by the enlarged hypophysis seems obvious. Certain changes in face and extremities, closely resembling those typical for acromegaly, are not uncommon in pregnancy (Tandler, Gross and Halban). Marek[61] reported a case in which a typical acromegaly developed during pregnancy which completely disappeared after labor.

It is generally conceded (Cushing, Peritz,[62] Olmstead and Gay[45]) that hyperpituitarism, as a rule, is associated with a distinct lowering of sugar tolerance and this fact in the opinion of many writers allows the deduction (e.g., Dietrich[13]) that the change in sugar tolerance observed during pregnancy may be ascribed to the physiologic hyperactivity of this gland. Wallis[63] insists that the blood-sugar curve after a glucose test meal in a pregnant woman is so typical of the curve of the hyperpituitary patient that the hypophyseal origin of the lowered sugar tolerance during pregnancy cannot be doubted. This view is accepted by Williamson[64] and others. Brown[65] finds great support for this idea by an observation in which a woman with slight symptoms of acromegaly during pregnancy developed a true diabetes.

We seem thus justified in assuming that the typical morphologic and functional change of the hypophysis observed during pregnancy can leave no doubt that it must influence the carbohydrate metabolism in the sense of a hypophyseal hyperfunction.

(f) *Pancreas.*—In speaking of the pancreas I can limit myself to refer only to certain facts which suggest or prove endocrine functional changes of this gland under the influence of pregnancy.

The etiologic significance of inflammatory or traumatic alterations

of pancreatic tissue in the origin of diabetes mellitus seems generally acknowledged. Allen and his coworkers[66] state in one of their conclusions: "Clinical diabetes apparently arises regularly on a basis of pancreatitis, either acute or chronic." In a report of Wilder[67] from the Mayo Clinic the fact is mentioned that out of a total of 298 diabetic patients the presence of an interstitial pancreatitis had been established or strongly suggested in 53 patients.

In a report of two cases of severe glycosuria developing during pregnancy, Henkel[68] suggested the probability of traumatization of the pancreas by the large uterine tumor, a theory which seems acceptable to Ehret.[69] A case of definite acute pancreatitis during pregnancy has been described by Haidlen.[70] In a report of a pancreas necrosis in a pregnant woman, Ellerbrock[71] emphasizes that this particular complication of pregnancy or of the early puerperium seemingly is rare since he could find only 5 other records of this occurrence in literature. He overlooked, however, as I find, e.g., an interesting report by Saenger.[72] Soon after an easy and spontaneous delivery a seemingly healthy patient died suddenly. Necropsy revealed an entirely unsuspected profuse hemorrhage caused by an extensive necrosis of the pancreas. Quite recently a similar observation has been recorded by Matthaei.[73] In an extensive paper dealing with apoplexy of the pancreas after labor, Plumper[74] quotes a few more cases from literature and describes in detail a case seen by him. He is, however, not inclined to believe that this necrosis necessarily stands in an immediate etiologic relation to pregnancy and labor. In a general discussion of the relations of the pancreas to genital function and diseases in the female, Prochownik[75] expressed the belief that severe indigestion symptoms and especially epigastric pain in pregnant women, usually ascribed to the gall bladder, might have been caused by temporary pancreas disease if not later found actually to be due to the gall bladder.

Observations of morphologic changes of the Langerhans islands under the influence of changed ovarian function and of pregnancy have been described by Italian authors. Rebaudi[76] found that in rabbits, guinea pigs and dogs the islands become hypertrophic and seemingly hyperactive after castration and even after removal of only the corpus luteum tissue.

Sirtori[77] described progressive changes of a degenerative nature during pregnancy, in his opinion indicating a gradually increasing hypofunction. Just the opposite, indications of hyperactivity of the islands during pregnancy, are found by Pepere, and later were confirmed by Ciulla.[78] While, on the other hand, Falco's investigations[79] on pregnant dogs convinced him that there are definite histologic signs of diminished activity. Thus we might conclude, that probably characteristic and physiologic morphologic changes do not occur in

the Langerhans islands during pregnancy. Obviously this does not exclude the possibility of either degenerative alterations under certain conditions, or of individual variations in the amount of islands tissue as the result of hereditary influence or of anomalies in development.

Of still undetermined significance in the problem here discussed is the following noteworthy fact: Cantoni[80] studied by means of the Gross-Einhorn method the external pancreatic secretions of 21 patients in various stages of pregnancy and the puerperium. He found during pregnancy, as compared with the puerperium, the proteolytic ferment diminished, the lipolytic ferment more diminished than the proteolytic, while the amylolytic ferment apparently had remained practically unchanged. Investigating the external pancreatic secretion in diabetic patients, Jones[81] discovered in 50 per cent a proteolytic activity below the minimum normal level, being in 30 per cent far below the minimum. The lipolytic activity also in 50 per cent was below the lowest normal figures, while only 10 per cent revealed a marked lowering of amylolytic ability.

The similarity of the results obtained by these two investigators is at least suggestive of alterations in pancreatic function during pregnancy resembling those of true diabetics.

A question of great importance in regard to endocrine pancreatic function during pregnancy has been opened by Carlson.[82] Can the fetal pancreas act vicariously for an underfunctionating maternal pancreas? Carlson found that a pancreatectomized dog will not develop the usual hyperglycemia and glycosuria when at the time of operation she is in an advanced stage of pregnancy, but that these sequelae of pancreatectomy will become manifest immediately after the intrauterine death, or after expulsion, of the fetuses.[83] This fact has been confirmed by Lafon[84] and also by Falco.[79] Allen[85] ascribes this failure of a glycosuria to appear to the pronounced cachexia of the operated animal. Carlson and Lafon admit that there are two possibilities which might explain the phenomenon, either that fetal pancreatic hormones are transmitted to the mother animal, or that the fetuses, without any embarrassment to their own carbohydrate metabolism, are able to dispose of the excess of maternal blood sugar by oxidation or storage. Falco advances still another explanation. The surplus of maternal blood sugar is metabolized by placental ferments entering the maternal blood. I shall have occasion later to show that this explanation is not in accord with newer information concerning placental function. Though not explained, the fact remains that this seemingly beneficial effect of pregnancy on a diabetes, artificially produced by the removal of the pancreas, sharply contrasts with the common clinical experience of the usually harmful effect of pregnancy on a diabetic woman. This discrepancy, however, is very likely due to a fact, merely suggested by Carlson,[86] namely that the

diabetes produced in an animal by extirpation of the pancreas possibly represents an entirely different type than that observed in the human. In my belief this idea of Carlson of an essential difference certainly might hold true for the pregnant woman, since in her the appearance of diabetic symptoms and also the aggravation of an existing diabetes, to a large extent, is dependent upon marked functional changes in other endocrines outside of the pancreas.

Carlson's observations on pregnant depancreated dogs bring up still other questions which are of considerable importance in considering a possible harmful effect of insulin, administered to a pregnant woman, on the fetus *in utero*, in case of its passage through the placenta. Carlson assumes that the fetal pancreas has a normal endocrine function. There exists in literature a unique observation of Dubreuil and Anderodias[87] which throws some light on this particular problem. At the end of the eighth month of her fourth pregnancy a diabetic woman expelled a live infant weighing 5000 grams in spite of its evident prematurity. At autopsy it was found that this child's pancreas contained, using the authors' own term, "gigantic" compact masses of islands tissue. In some of the microscopic fields this tissue occupied one quarter of the space. They think that a persistent passage of blood sugar from the hyperglycemic mother to the fetus accounts not only for his large size, but also directly led to the enormous formation of islands tissue. "It developed for the protection of the child against a hyperglycemia," and thus, they conclude, these findings prove normal endocrine pancreatic function in the fetus. This view is supported by the observation of Aron[88] that the glycogenic activity of the fetal liver evidently begins with the first appearance of islands tissue in his pancreas.

Since many writers and many textbooks of obstetrics rather definitely speak of deficient pancreatic function of the newborn as the result of the mother's diabetes, it becomes necessary to consider in this connection the question of hyperglycemia and glycosuria of the newborn.

Schauta[89] thought that such fetuses so often are stillborn, because they have succumbed to a disease "analogous to that of the mother." Wolff[90] asserts that 10 per cent of living babies born by diabetic mothers die from diabetes within the first year of life. He thinks that a disturbed carbohydrate metabolism during intrauterine life in these infants is proved by an enormous accumulation of glycogen in all their organs, ascertained by him in two cases. Outside of one case of temporary glycosuria appearing in a baby 18 days old, reported by Chambrelent,[91] I have failed to find any confirmation for such views in a careful search through obstetric and pediatric literature. In 1890, Stern[92] published a list of 117 cases of diabetes in children so far recorded in literature. Among these were but 6 instances of infants

less than a year old. Among these six there is but one case of a newborn, showing a glycosuria at birth, and this particular case, as a matter of fact, has been reported in the year 1852. These six cases, cited by Stern, I suppose have reappeared in many of the later surveys. There is another collection of such cases extant, prepared by Wegeli[93] including 108 other observations of diabetes in infancy. Among them there are only three children less than one year old, the youngest being three months old. In the data on all these 108 cases only in two the fact is mentioned that the mother also was a diabetic. Kochmann,[94] in 1922, emphasizes that diabetes within the first year of life undeniably is extremely rare and that all the earlier reports should be disregarded because in them the diagnosis of diabetes obviously was based solely on the presence of some reducing substance in the urine.

A traumatic glycosuria of the newborn has been described by Hoeniger,[95] supposedly the effect of a cerebral traumatism after forceps extractions. In control observations, made by Lindig,[96] however, but three of 27 newborns extracted with forceps showed a slight glycosuria of very short duration.

A blood-sugar determination on newborn infants for obvious reasons was possible only for the past few years. Cannata,[97] Sedgwick and Ziegler,[98] Guy[99] and others agree that the fasting values are approximately normal, slightly below the normal average of adults. More directly connected with the question under discussion are rather uniform findings, e.g., by Morriss[100] or Rowley[101] that a comparison of maternal and fetal bloods, both obtained simultaneously in the moment of birth, shows almost invariably a slightly higher blood-sugar concentration of the maternal blood. This observation is still another valid argument against the theory that the passage of the maternal sugar to the fetus is determined by the action of a glycolytic ferment in the placenta, and thus, as already mentioned, weakens further the theory of Falco[79] that placental ferments, passing into the maternal blood, might prevent a hyperglycemia of the mother. It also has been shown that a physiologic hyperglycemia during labor, especially when anesthetics are employed (Frey,[102] Rowley,[101] Walthard[103]) or in eclamptics (Widen[104]) does not raise the fetal blood-sugar above its normal limits, but only accentuates the existing difference in favor of the maternal blood.

Summarizing available information concerning fetal and maternal pancreatic function during pregnancy we can say: We possess no definite evidence of a physiologically altered function in the mother. We have evidence that the pancreas of the fetus functionates normally, but not the slightest proof for the transition of islands hormones from the fetus to the mother, or *vice versa*. We may assume that in accord with the law of diffusion in a diabetic mother a larger amount of sugar

is passed through the placenta to the fetus, but it seems that the latter is able to metabolize properly this excess, a fact which may explain the common observation that babies of diabetic mothers are very heavy. A baby born by a diabetic mother, however, is not likely to show a glycosuria or other signs of diabetes at birth.

VEGETATIVE NERVOUS SYSTEM

In view of the acknowledged intimate relation of the vegetative nervous system to the endocrine system, it is difficult to deal with the former in a separate chapter. There are, however, certain facts, intimately connected with changes of the nervous system during pregnancy that can be grouped together more conveniently in this manner.

Is the sympathetic nervous system during pregnancy in a state of increased irritability? Aschner[105] answers this question with yes. Motzfeld[106] more cautiously says that for the present we must be content with the vague idea of an increased sympathicotonus. Bauer[50] admits the difficulty of making any statement concerning the state of the entire system, because only certain of its parts or only certain of its functions can be studied by means of pharmacodynamic tests or physical examinations. As far as the specific problem under discussion is concerned, we can say that the sympathicus stimulates thyroid, adrenals and hypophysis and that, as shown in preceding pages, these glands, all active in the mobilization of sugar into the blood, during pregnancy are in a state of more or less marked hyperfunction.

Of greater importance in our problem, however, is the probable existence in the central nervous system of a center controlling or regulating carbohydrate metabolism. Some physiologists and most clinicians believe in its existence. I will only mention the classic *piqûre* experiment of Claude Bernard and the variously confirmed observation of Aschner[105] that also injury of the hypothalamus causes hyperglycemia and glycosuria persisting up to the death of the animal. A most noteworthy addition to available information concerning the existence of such a center, very recently, has been supplied by Dresel and Lewy.[107] They found in every case of diabetes mellitus, at postmortem, pronounced degenerative changes in the globus pallidus of the corpus striatum. In their belief these findings prove that here is located a center which regulates the blood-sugar level, by controlling stimulations sent to both the sympathetic and parasympathetic cells of the vegetative nucleus in the oblongata. Their effect is antagonistic and thus counterbalances glycogenesis and glycogenolysis.

MAINTENANCE OF BLOOD-SUGAR CONCENTRATION

All authorities agree that in healthy pregnant women blood-sugar concentration varies within normal limits (Benthin,[108] Bergsma,[109] Boutot, Clogue and Lantuejoul,[110] Guggisberg,[111] Morriss,[100] Rowley,[101]

Ryser,[112] Schiller,[113] Walthard[103]). We must conclude from this fact that the automatic mechanism maintaining blood-sugar concentration proves fully competent also in pregnancy—*in spite of the acceleration of sugar mobilization as the result of certain endocrine changes.* This seeming preservation of the equilibrium between glycogenesis and glycogenolysis cannot be explained on the basis of a physiologic impairment of islands function, as I have shown in speaking of the pancreas. Any acceptable explanation will necessarily have to take into account also the evident liability of the pregnant woman to develop a glycosuria at a blood-sugar level within normal limits. In view of these facts it seems reasonable to think of changes in the behavior of the renal threshold for sugar under the influence of pregnancy. Might it be that during pregnancy some of the sugar, quickly passed into the blood, is permitted to flow promptly into the urine by the automatic lowering of the threshold?

RENAL THRESHOLD FOR SUGAR

Space will not permit to enter here into an adequate discussion of the complex and not yet fully understood problem of the renal threshold for sugar. However, the following facts can be accepted as firmly established: Not every increase of blood-sugar concentration above the usual and normal level causes a glycosuria. In a nondiabetic individual the blood sugar, as a rule, may rise to 0.17 per cent before glucose in appreciable amounts can be found in the urine. This degree of blood-sugar concentration, therefore, rather generally has been accepted as the normal renal threshold. This threshold is not only raised or lowered by certain pathologic conditions, but varies considerably in different seemingly healthy individuals, and changes, under certain influences, also in the same individual.

Medical literature often rather definitely speaks of a lowered or increased ability of the kidney to act as a filter for sugar though physiologists still are uncertain whether a certain glycosuria is due to an actual alteration in the permeability of the glomeruli for sugar, or possibly is simply the expression of retardation or acceleration of the blood stream as the result of contraction or dilatation, respectively, of renal capillaries, and whether under other conditions some or all of the urinary sugar might not represent sugar normally stored in the renal tissues in the form of glycogen. I, therefore, wish to emphasize that in the following the admittedly inaccurate terms renal threshold and renal filter are employed merely to express in a general way the relation between the appearance of a glycosuria and the sugar concentration of the blood at that moment.

We are acquainted with the fact that the renal threshold of an individual is not stable and that it is markedly lowered almost instantaneously, under the influence of a sudden emotion or by the injection

of certain organ extracts (e.g., adrenalin) or of drugs (e.g., phlorizin). In spite of a blood-sugar concentration below 0.17 sugar suddenly appears in the urine. Believing in the existence of an automatic mechanism which maintains the equilibrium between the two antagonistic functions of glycogenesis and glycogenolysis I consider it entirely plausible that also the variable renal threshold stands under the control of this regulating center. In view of the evident acceleration of the sugar utilization process during pregnancy as the result of the simultaneous hyperactivity of several endocrines, a prompt automatic lowering of the threshold undeniably would represent an ideal means of avoiding an abnormal rise of the blood-sugar contents after the intake of one large dose of carbohydrate. It is a fact that just under this condition the lowering of the threshold manifests itself during pregnancy, and therefore I feel justified in concluding that the striking lability of the renal threshold of the pregnant woman, utilized in the various diagnostic tests and evidenced in the not uncommon postprandial glycosuria, really represents a protective measure against a hyperglycemia which otherwise would seem inevitable in view of the existing stimulation both of sugar assimilation and of glycogenolysis.

VARIOUS TYPES OF GLYCOSURIA

The problem of the physiologic lowering of the renal threshold has become one of great interest and practical importance to the obstetrician. In obstetric literature, as already mentioned, today it is spoken of as renal diabetes or alimentary glycosuria. In my belief both terms are incorrectly applied to the phenomenon.

Renal Diabetes, as understood by clinicians, is a condition of abnormally increased renal permeability for sugar, existing as a chronic condition in otherwise healthy individuals. In this disease, in spite of a blood-sugar concentration at or even below the normal level, a moderate degree of glycosuria persists rather independent from the carbohydrate intake. Clinicians insist that the diagnosis of renal diabetes is determined by the definite exclusion of any toxic condition and of any anomaly in the nervous or endocrine systems which might account for a glycosuria. It seems rather obvious that conditions are essentially different in the pregnant woman. She represents an individual in whom hypophysis, adrenals and thyroid most probably are in a state of hyperactivity, who often even early in pregnancy exhibits the signs of toxicosis, who is subject to emotions, and very often shows evidences of other disturbances in the function of nervous and endocrine systems. She manifests a glycosuria, not as a persistent symptom, but only after the injection of minimal doses of adrenalin or phlorizin and especially after the ingestion of one larger dose of glucose, levulose or even only of starch. The pregnant woman, as I see it, has with the patient suffering from a renal diabetes

nothing in common except that in both of them sugar flows into the urine with a blood-sugar concentration below the level of 0.17. But also in this respect a difference exists, which I consider to be most significant: In renal diabetes the low threshold is a fairly permanent condition, in the pregnant woman it becomes evident solely under the influence of certain procedures.

Alimentary Glycosuria, in the view of the clinician, indicates a definite weakness within the mechanism of carbohydrate utilization of the individual.

These patients are barely able to metabolize properly the usual amount of carbohydrate taken within 24 hours in the average mixed diet, but fail to assimilate a larger amount. Postprandial hyperglycemia is marked and likely to be associated with a brief glycosuria. In contradistinction to renal diabetes, in them the glycosuria is definitely dependent upon the sugar intake. From this point of view an objection must be raised against the custom of employing in obstetric literature the terms renal diabetes and alimentary glycosuria as synonyms. The clinician makes a strenuous though at times vain effort to keep these two types of glycosuria strictly apart.

Comparing the glycosuria of the pregnant woman, manifesting itself after one large dose of sugar, with alimentary glycosuria, in its clinical meaning, we also can discover noteworthy differences. In a case of clinical alimentary glycosuria there exists a general inability to metabolize food carbohydrates taken in amounts well within the very wide limits of variation allowed by a normal carbohydrate metabolism. Naturally this *general lowering of sugar tolerance* will manifest itself when a glucose test meal is given, also in a reduction of the *immediate assimilation power*. It is incorrect and unjustifiable, however, to speak of a general lowered sugar tolerance in pregnancy because, as a matter of fact, the pregnant woman is physiologically forced to increase the total food and with it the carbohydrate intake in order to supply the needs of the fetus. This increase of the carbohydrate intake, however, does not cause by itself a glycosuria. The pregnant woman shows a weakness in her sugar metabolism *only* in a distinct lowering of her ability to assimilate properly one large dose of carbohydrates, glucose, levulose or even starch. This represents, in my opinion, so essential a difference from clinical alimentary glycosuria that it cannot be disregarded. It is this fact which induces me to assume that the postprandial glycosuria of the pregnant woman cannot be due to the same causes presumably at work in the case of a clinical alimentary glycosuria, but that it seems more reasonably ascribed to a prompt lowering of the renal threshold, required during pregnancy as a protective measure in the face of greatly accelerated sugar mobilization.

The demand for a greater amount of carbohydrate during preg-

nancy and the speeding up of its metabolization is fully in accord with our present biologic conception of a specific constitutional endowment of woman for the purpose of reproduction. It is significant that these radical changes in the sugar utilization process together with certain manifestations of its anomalous function, as a rule, cease promptly with the termination of pregnancy. The various diagnostic tests, enumerated above, fail to produce a glycosuria as soon as the state of pregnancy has been terminated by the expulsion or the death of the fetus.

DIABETES

In some instances, however, a permanent disturbance of the carbohydrate metabolism in form of a true diabetes can be observed. In part at least such an unexpected development must be ascribed to our present inability of diagnosing with certainty, or differentiating in every case between a renal diabetes, an alimentary glycosuria and a diabetes mellitus, the three types of glycosuria presumably representing definite pathologic entities. With increasing frequency instances are reported in which patients, seemingly suffering from a harmless form of glycosuria, or apparently only from a diabetes insipidus, finally prove to be true diabetics. As obstetricians we naturally must be interested in the question whether pregnancy might be responsible for the development of diabetes mellitus.

Simply from a clinical point of view the possibility must be admitted. With more justification than ever before we can speak today of a constitutional disposition, inherited or acquired, which under the influence of an added factor as immediate cause will lead to diabetes. Excessive intake of carbohydrate, toxic conditions and alterations of endocrine function are generally accepted as the most common of such provocative factors. All three of them, singly or in combination, are present in the majority of pregnant women. By themselves, however, they are unable to produce the disease. Diabetes mellitus, according to our present conception, presupposes impaired pancreatic function.

Impaired pancreatic function antedating impregnation, therefore, is likely to become more marked during pregnancy. A preexisting diabetes, as we know, usually shows marked progression under the influence of pregnancy. But also a glycosuria, seemingly only of the alimentary type, might develop into a true diabetes as the result of further deterioration of endocrine pancreatic function. Cases of diabetes manifesting themselves first in the course of pregnancy are on record, and I am able to add another observation of this occurrence.

We know that a relative functional insufficiency in various organs of the pregnant woman (kidney, liver) at times, gradually and insidiously, will turn into a definite and permanent pathologic lesion, i.e.,

into actual disease. In my opinion, these gradual functional and morphologic changes in the course of gestation represent a fruitful, and not sufficiently explored field for the search of the origin of certain diseases, and for the study of predisease states, if I may use this term in analogy to that now much employed word, precancerous state. A careful analysis of the alterations during pregnancy in the process of carbohydrate metabolization certainly throws light on the problem of the origin of diabetes. The pregnant woman not infrequently offers occasion for realization of the fact that no sharp line can be drawn between alimentary glycosuria and diabetes; she also offers valuable opportunity for exact observation of the very first manifestations of a true diabetes. I shall point this out more conveniently by describing and discussing a routine procedure for the study and management of the glycosuric pregnant patient, which I have adopted in my own work.

While taking the patient's first history an effort should be made to obtain definite or suggestive information concerning a previous glycosuria.

If in the course of prenatal care, with urinalysis made every three weeks earlier and every two weeks later in pregnancy, sugar is discovered in the urine, the patient is asked whether she has taken an unusually large amount of sugar within the past 24 hours, probably in form of candy. In my experience an affirmative answer most likely will be given. The patient is asked to refrain from candy, very sweet pastry, etc., for the next 48 hours but without other marked change in her usual diet. At the next test, as a rule, the urine will be found free of sugar. This patient is then told to avoid using sugar in excessive amounts.

If sugar is found also at the second examination, the urine is reserved for a fermentation test to determine whether it contains glucose, and the patient is instructed to reduce her sugar intake to a minimum. No other restriction of carbohydrates is demanded. In case the fermentation test shows glucose, the fasting blood-sugar concentration is determined immediately. If the blood-sugar is found well within physiologic limits, i.e., below 0.1 per cent, a carefully arranged diet is likely to keep the patient aglycosuric. If even under faithful observance of this restricted diet occasionally sugar appears in the urine, another blood-sugar determination is combined with a sugar assimilation test and her blood-sugar curve obtained. A warning must here be added.

The fact is well known that but one large load of glucose may start a long continued glycosuria (Kawachi[50]) or change a so-called potential diabetic patient into a true diabetic (Gray[114]). Therefore it is reprehensible to give to a woman 100 or 200 grams of glucose solely as an aid in the diagnosis of pregnancy without a preliminary deter-

mination of her fasting blood-sugar. The absence of sugar in her urine can be misleading since long-continued hyperglycemia often leads to a considerable rise of the renal threshold so that even a true diabetic at times is found aglycosuric.

A test for the assimilation power of sugar in a pregnant woman, therefore, must always be made with special care, beginning with relatively small loads. The blood-sugar curve might place the patient definitely into the group of diabetics or definitely exclude her from it. In many instances, however, the obtained sugar curve, I think as a result of the existing disturbance in endocrine function, will at least suggest the plateau type or will transgress the physiologic upper level, so that it will be impossible to diagnose from the curve with exactness the character of the disturbance of the carbohydrate metabolism. We are told by Gray[114] that every clinician is faced with this dilemma, the obstetrician it seems unfortunately more often. These cases belong into that indefinite group of potential or suspected diabetes and, to their advantage, are best handled as diabetics, especially when pregnant, since in them notoriously harmful influences will continue to exert their deleterious effect up to the termination of pregnancy. All these patients, therefore, should be treated and managed like true diabetics.

TREATMENT OF DIABETES DURING PREGNANCY

Severe and long-continued diabetes almost regularly leads to amenorrhea and sterility. For this reason the obstetrician usually will deal only with comparatively light cases or those truly in the incipient stage.

The essential part of the treatment of diabetes still consists in the regulation of diet. There is, however, one point which requires due consideration in the dietetic treatment of a pregnant woman. Her caloric needs in general, and her carbohydrate needs in particular, are markedly increased. Pregnant women tolerate badly any rapid or marked reduction of the carbohydrate intake. Harding and Potter[115] very recently, in a very thorough study of the effects of starvation, brought out the important fact that in pregnancy the disturbances caused by a lack of carbohydrates are more intense than in starvation. Motzfeld[106] asserts that a ketonuria is often seen in pregnant women even after only a moderate restriction in the carbohydrates. Indeed, Pritzi and Lichtmann[116] consider this acetonuria frequent enough to be of some value in the diagnosis of pregnancy, since they saw it follow carbohydrate restriction in 39 out of 44 pregnant women tested in this manner. Personally I have no doubt that the frequency with which death in coma is recorded in these cases in obstetric literature is to a large extent due to hasty restriction of

the carbohydrates when a large amount of sugar suddenly is discovered in a pregnant woman.

If dietetic measures fail to bring the blood-sugar near a normal level and the glycosuria continues, without fear or hesitation, insulin should be administered. When resorting to insulin for the first time I was not free of fear. At that time no case of insulin treatment of a pregnant woman had been recorded in literature. I was, for example, greatly disturbed by the thought that insulin might pass to the fetus as other substances undoubtedly do. My apprehension in this and many other respects has been completely dissipated by careful search for all available information. The conclusions drawn from these studies I have presented in part in the preceding pages.

Very briefly I shall quote but a few interesting data concerning the case which started my interest in this problem.

In the course of routine prenatal care a marked glycosuria was discovered, about three weeks after the preceding negative urinalysis, in a heretofore very healthy, young primigravida, six months' pregnant. She had recently noticed increased thirst but always had been a hearty eater. Further examination showed a glucose output of 66 grams in 24 hours and a fasting blood sugar of 0.26. All efforts to reduce the blood sugar or to eliminate the glycosuria by diet failed. After careful consideration a trial with insulin was decided on. With gradually increasing doses the patient was finally rendered and kept aglycosuric for the rest of her pregnancy with 40 units of insulin per day, given in three injections, together with a diet consisting of 120 grams of carbohydrates, 50 grams of protein and 200 grams of fat, representing 2480 calories. The blood sugar fluctuated between 0.107 and 0.131. She was perfectly comfortable, and exactly at the expected time she passed through an uneventful labor, being delivered of a living child weighing 3410 grams. In the moment of birth blood was simultaneously obtained from the mother and the umbilical cord. Maternal blood showed a sugar concentration of 0.144, the infant's blood of 0.140, thus representing the seemingly characteristic difference, already mentioned, and the maternal blood showing a slightly higher concentration than at any time since insulin was used, proving the physiologic rise during labor. Immediately after labor, as a precaution, insulin was reduced to 20 units. Maternal blood-sugar on the second day postpartum was 0.103. When after an injection of 10 units on the second day the patient reacted with the typical symptoms of a hypoglycemia, all insulin was stopped. With gradual return to her previous diet of 2480 calories and without insulin the patient remained aglycosuric, the blood sugar having fallen to 0.08 on the sixth day postpartum. The baby was at birth, and remained, aglycosuric and developed normally. The amniotic fluid, normal in amount, did not contain sugar.

For the next several months, not keeping exactly to her diet, the patient was well in every respect. She was not nursing her baby because I thought it unwise to risk the otherwise necessary increase of food. My medical consultants felt not ready to agree with my own diagnosis of diabetes mellitus. The prompt and seemingly complete recovery immediately after labor appeared suspicious. They preferred to term it a case of acute pancreatic insufficiency during pregnancy. Unfortunately the fact is now fully confirmed that this is a

case of diabetes mellitus first appearing during pregnancy. Recently this patient was attacked by a polyarticular rheumatism which caused all the characteristic signs of diabetes to reappear.

It is my belief that insulin will reduce practically to nothing the admittedly grave dangers of a complication of pregnancy with diabetes, both as far as mother and infant are concerned. In the light of our new conception of diabetes obviously all older statistics have become unreliable. They date, without exceptions, back to the time when a marked glycosuria meant diabetes and the absence of sugar from the urine definitely excluded this disease. In general, however, these statistics, furnished, e.g., by Colorni,[117] Cron,[118] Fruhinsolz,[119] Geelmuyden,[120] Offergeld,[121] Reinhardt,[122] Umber,[123] Williams,[124] demonstrate the fact that in this complication of pregnancy great danger arises to the mother from the rapid progress of her disease, from the likelihood of an operative procedure of some sort required for termination of the pregnancy or during delivery, from her general unfitness to stand an operation or a general anesthesia, and from the increased danger of a septic infection. Diabetes greatly raises fetal mortality through the probability of intrauterine death, of premature labor, spontaneous or induced, and through complications of labor caused by hydramnion or the abnormal size of the child. I deliberately omit the one more risk mentioned in most textbooks, namely, the probability of the infant's being diabetic at birth.

It will take many more years before an adequate number of pregnant women will have been treated with insulin to permit a statistical study of results, but I think that our present knowledge of insulin effect is sufficient to justify the following conclusions or prophecies. The progress of the disease will be greatly retarded if not actually checked. Among all physicians the obstetrician has the best opportunity to discover, in the course of routine prenatal care, diabetes in its earliest stages. There is some evidence existing that insulin actually has a curative effect in early or mild cases (Horder,[125] Leyton,[126] etc.). Therefore, the obstetrician might be able even to prevent the development of a true diabetes in some of his glycosuric pregnant patients by paying proper attention also to blood-sugar changes. Since the obstetrician comparatively rarely has to manage a chronic diabetic patient, he will usually be able to maintain his potentially or actively diabetic patients, for the rest of their pregnancy, in a state not different from the healthy woman as far as her relation to the fetus *in utero* is concerned. There is likelihood that under insulin treatment the amniotic fluid would be normal in amount, and the fetus of normal size. These two facts eliminate for the fetus the dangers incident to abnormal labor and operative delivery. There should but rarely, if ever, arise the necessity for interruption of pregnancy. If an operation should become necessary, the mother would prove a

normal operative risk. There then solely remains the problem of increased susceptibility to septic infection. Authorities still disagree as regards the cause of the evident frequency of wound infection and disturbed wound healing in the diabetic patient. Some believe it to be due to the sugar in the tissues while others ascribe it to vessel changes. Both probably are right, but the obstetrician fortunately is not concerned with this disagreement. Vessel changes presumably exist only in the chronic cases, the type which the obstetrician but rarely sees. His patients under insulin treatment will have only a normal amount of sugar in the tissues.

To speak concerning the seeming value of insulin given simultaneously with intravenous introduction of glucose in the treatment of pernicious vomiting or of other types of acidosis with which the obstetrician has to deal (Thalhimer[127]) falls outside the scope of this paper and, therefore, in closing I shall limit myself to the assertion that in every textbook of obstetrics the chapter dealing with the complications caused in pregnancy by severe glycosuria or diabetes requires immediate and thorough revision.

Briefly summarized, the views presented in this paper are as follows:

In marked difference to man, woman is basically equipped to bear children. This specific constitutional endowment necessarily causes definite functional changes in various organs outside her genitalia during the various phases of her generative activity, changes, for obvious reasons, most pronounced during pregnancy.

The changes are expressed not only in the functional alterations of single organs but also of coordinate organ function, e.g., in the entire endocrine system. Changes in those endocrines, admittedly of importance in the carbohydrate metabolism, during pregnancy uniformly are of a nature to indicate that they are hyperactive in the sense of sugar assimilation. This is entirely in accord with the necessity of increased carbohydrate intake for the needs of the fetus. In spite of increased and accelerated sugar assimilation during pregnancy, blood-sugar concentration as a rule remains within the normal limits.

The automatic mechanism, which maintains the blood-sugar level under the antagonistic effects of glycogenesis and glycogenolysis, during pregnancy proves adequate. Seemingly this is accomplished by making readier use of another available means of preventing a hyperglycemia, namely, by a prompt lowering of the renal threshold. An outlet thus is offered for the escape of some of the sugar which is passed quickly into the blood of the pregnant woman through the evident speeding up of the carbohydrate assimilation process. This prompt lowering of the renal threshold as a protective measure in pregnancy is expressed in the decidedly common appearance of a glycosuria after the intake of glucose, levulose or even starch in

amounts which in the nonpregnant healthy woman fail to provoke this pheomenon.

This artificial glycosuria, often seen very early in pregnancy, and for this reason employed as an aid in diagnosis, in itself is neither a renal diabetes nor an alimentary glycosuria in the usual clinical meaning of these terms.

Diabetes is a disease dependent upon insufficiency of endocrine pancreatic activity. In women, in whom pancreatic function before impregnation is only barely sufficient or already slightly deficient, the necessity of increased carbohydrate intake, toxic conditions and alterations in endocrine function, during pregnancy may lead to a true diabetes mellitus. It seems probable that insulin will practically eliminate all the many known grave dangers, to mother and child, arising through a complication of pregnancy with diabetes.

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A MORPHOLOGIC STUDY OF SOME PHASES IN THE DEVELOPMENT OF THE SEX GLANDS OF THE DOMESTIC PIG*

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THIS study was undertaken as a prelude to a more extensive study of certain phases in the development of the human sex glands. A common mammalian type, the domestic pig—*sus scrofa domesticus*—was selected, material from this species being readily obtainable from local abattoirs, and I have succeeded in collecting a very complete series of specimens of developing sex glands, beginning with the earliest stages in embryos of 6 mm. in length and continuing up to the end of pregnancy, which in the pig lasts approximately four months.

The pregnant uteri obtained from freshly killed animals were brought at once to the laboratory, opened, and in the case of the youngest specimens, the wolffian bodies with the attached sex glands were dissected out, while in the older stages the sex glands alone were removed. As a fixative a saturated solution of bichloride of mercury, acidified with 5 per cent glacial acetic acid, was used, and after dehydration, the material was cut in sections 5 and 10 microns thick and stained by various methods. On the whole, the iron-hematoxylin method of Heidenhain was found to be the most satisfactory.

With material obtained from abattoirs it is impossible to determine the age of the various embryos from the sexual history of the animals, as this, of course, is lacking, so the length measurements have been taken as the criteria in differentiating the various stages.

It would seem unnecessary to review the extensive literature which has accumulated on this subject since the appearance of Waldeyer's fundamental work in 1870. For a full review of this subject, the reader is referred to the very complete articles by Waldeyer, as well as those of Felix and Buhler in Hertwig's *Handbuch*, and also the published studies of von Winiwarter and Sainmont on the sex glands of the rabbit, cat and human species. Among those who have studied the development of the sex glands of the pig, B. M. Allen, Skrobansky and Louise McIlroy deserve particular mention.

The course of events can be best understood by a study of the developmental changes in successive stages.

In either sex the first sign of a sex gland is to be found in a slight thickening of the celomic epithelium on the inner side of each wolffian body. This is to be observed in embryos as small as 7 to 8 mm. in

*Lantern demonstration made by invitation before the American Gynecological Society, May 15-17, 1924.

length, (probably 16 to 17 days old). In this early stage the celomic epithelium assumes a more or less columnar arrangement and begins to undergo proliferation, as evidenced by the presence of numerous mitotic figures. The transition between the epithelium of this region, the future genital ridge, and the epithelium covering the remainder of the wolffian body is, however, in this early stage a gradual one, and on the inner side the thickening may be observed to extend over the root of the intestinal mesentery.

DESCRIPTION OF SPECIMENS

Embryo 14 mm. At this stage the wolffian bodies are relatively large structures filling out almost entirely the lateral and posterior portions of the abdominal cavity. The sex gland "anlage" now forms a distinct ridge on the inner side of each mesonephros, and it extends throughout practically its entire length (see Fig. 1—left). In the pig, however, only the middle third of this original genital ridge develops into the sex gland proper (see Fig. 1—right—embryo 22 mm. in length.)

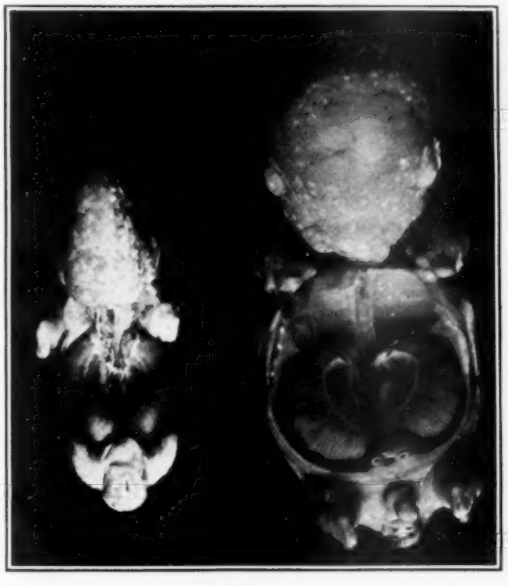

Fig. 1.—Left, pig embryo 14.5 mm. Right, pig embryo 22 mm. Note large wolffian bodies and sex gland region.

Fig. 2 represents a cross section through the dorsal region of a 14.5 mm. embryo. From a study of this section some idea of the relative magnitude of the wolffian bodies can be obtained. The genital ridge can be seen in cross section on the inner side of each mesonephros, the two being separated by the intestinal mesentery. A microscopic study of the cells composing the genital ridge at this stage is of interest.

The cells of the surface epithelium (germinal epithelium of Waldeyer) are arranged in such a manner that their long axes are at right angles, or lie obliquely to the underlying cells. They appear to be proliferating rather rapidly, mitotic figures being fairly numerous, and in places cells are being extended from this

layer into the underlying portion of the sex gland. The great majority of the cells in the underlying portion of the sex gland, which have originated in the above manner from the proliferation of the celomic epithelium, fall in the class of oogonia of the undifferentiated type, and have round or oval nuclei of the protobroque type according to the terminology introduced by von Winiwarter. Their cell bodies are not distinct. An occasional cell of another type is to be observed. These are large round cells with a clearly defined cell body, and contain a large round nucleus whose chromatin is arranged in a network of thin strands. A nucleus is usually to be found. The frequency of their occurrence

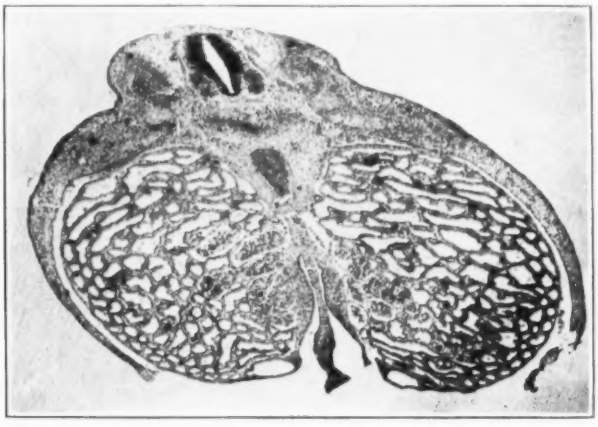

Fig. 2.—Section through dorsal region of 14.5 mm. pig embryo, X20. Note large wolffian bodies in cross section, also genital ridges on their inner sides.

Fig. 3.—Cross section through wolffian bodies and sex glands of an 18 mm. pig embryo. X20.

is very variable. One may examine several sections and find none at all; on the other hand, several such cells are sometimes found in a single section. They are to be found in the surface epithelium, as well as in the deeper portions of the genital ridge, and I have also observed them in other portions of the celomic epithelium, apart from the sex glands: for example in the peritoneal covering of the mesentery. These cells represent the "Ureier" or primordial ova of Waldeyer. They, however, never develop into mature oocytes or spermatocytes, and Allen is probably correct in describing them as primitive sex cells which have undergone a precocious development but for some reason fail to undergo further development.

Embryo 18 mm. in length (Fig. 3). The general increase in size of the sex gland is quite pronounced, so that in section it now appears as a very marked elevation upon the inner side of the mesonephros to which it is attached by a rather broad base. No tendency towards a cordlike arrangement of the cells composing its general mass is to be made out, rather they are grouped together

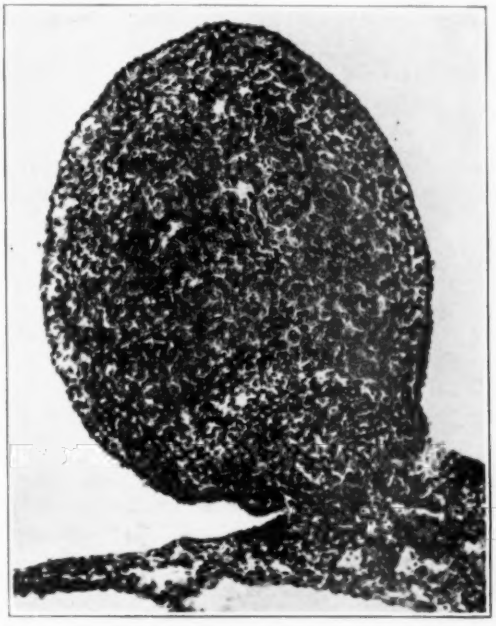

Fig. 4.—Section of sex gland from a 22.5 mm. pig embryo—female. X150.

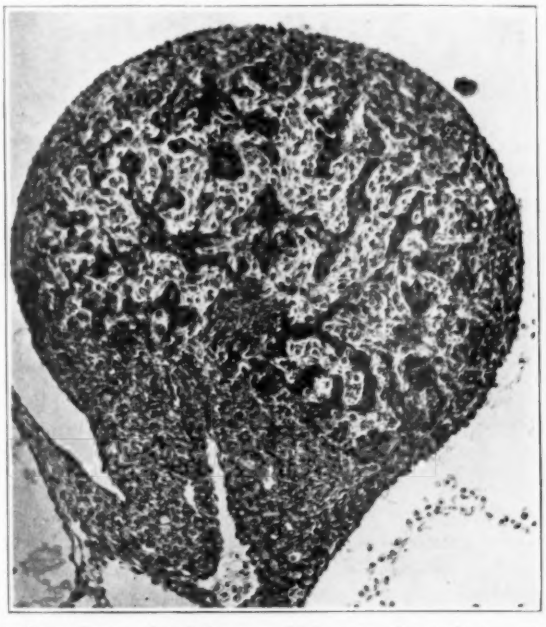

Fig. 5.—Section of sex gland from a 22.5 mm. pig embryo—male. X140.

in a compact arrangement. (It must be borne in mind that variations in the arrangement of the various structures composing the sex gland are to be found, according to the species studied.) The types of cells encountered are similar to those met with in the earlier stage—chiefly oogonia with the protobroque type of nucleus, with an occasional primitive sex cell scattered among them. A new feature, however, is to be observed in the beginning formation of a delicate connective tissue layer between the surface epithelium and the underlying mass of oogonia. The sex gland is still in the indifferent stage, that is to say, it is impossible to decide from the histologic picture presented, whether the given specimen is of the male or female sex.

Embryos 22.5 mm. in length. (Figs. 4 and 5). At this stage the distinction between the two sexes is to be made out with ease. The two embryos under consideration were obtained from the same litter, were of the same size, and appeared to be identical in their general development, yet most striking differences are to be observed in the sex glands.

In the testis (Fig. 5), the following characteristics are to be observed.

1. The surface epithelium has assumed a flattened appearance. From now on it takes no further part in the production of the active sexual products of the testes but simply forms an inactive epithelial covering.

2. Immediately beneath the surface layer is a well defined layer or rather densely arranged connective tissue—the tunica albuginea—which is a permanent structure and corresponds to the albuginea layer of the adult organ.

3. The central mass of cells has rather suddenly become broken up into a series of branching and anastamosing solid cords of cells, separated from one another by the intermediate cords of connective tissue and interstitial cells. These branching cords are the forerunners of the seminiferous tubules.

Comparing the ovary (Fig. 4) with the findings noted above one finds:

1. The surface epithelium retains a distinctly cuboidal appearance.

2. Immediately beneath the surface epithelium is a rather broad layer of loosely arranged connective tissue. This corresponds to the albuginea layer of the testis but in the ovary it is only a temporary structure, the albuginea of the mature organ not appearing until a later date.

3. In the central part of the sex gland the oogonia are still arranged in a compact mass with practically no tendency towards a cord-like arrangement. This central mass of cells in the ovary represents the end-result of what von Winiwarter describes as the first proliferation of the surface epithelium, and it is almost, although not entirely, cut off from connection with the surface epithelium.

From the above findings it is noted that the signs of sexual differentiation in the male are of a distinctly positive character, whereas in the female, they are partly positive and partly negative—differentiation going on more rapidly in the testis than in the ovary

In addition to the above sign of differentiation certain differences in the vascularization of the testis and ovary are to be observed as was pointed out by Clark. In the testis, the spermatic artery after entering the hilum, pursues its course in the albuginea layer ascending in a longitudinal direction towards the cranial pole, at the same time giving off lateral branches, as well as others which invade the substance of the organ.

In the ovary, however, after entering the hilum, the artery gives off numerous radial branches which follow a somewhat tortuous course and end under the surface of the organ.

Embryos 32 mm. in length (Figs. 6 and 7.) In the testis (Fig. 6) the organ as a whole is seen to have undergone marked development; the sex cords are bet-

ter defined and a well marked pedicle is noted. Otherwise, there are no pronounced changes as compared with the previous stage.

In the ovary (Fig. 7), however, very marked changes are noted when com-

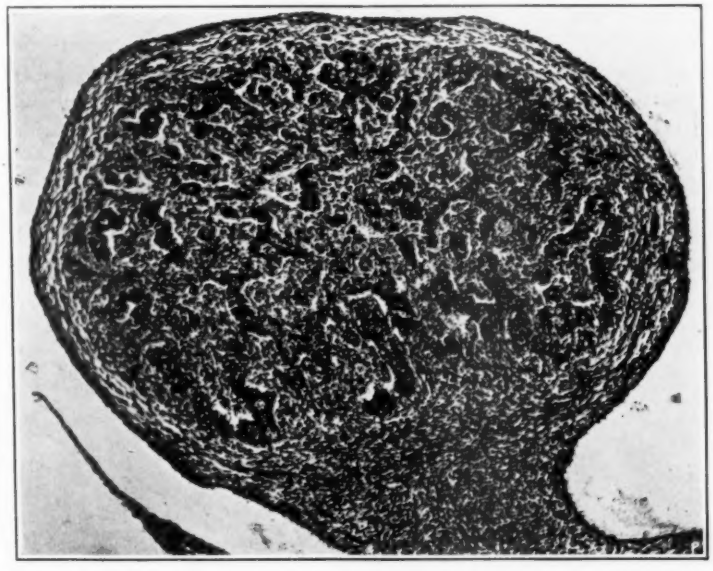

Fig. 6.—Section of sex gland from a 32 mm. pig embryo—male. X90.

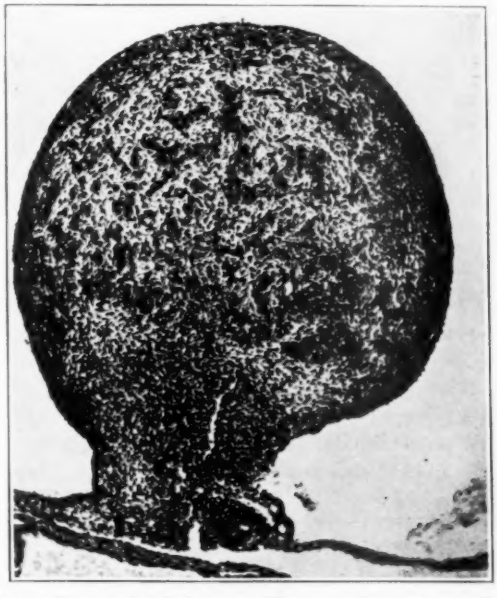

Fig. 7.—Section of sex gland from a 32 mm. pig embryo—female. X100.

parison is made with the preceding stage. The central mass of cells has become more loosely arranged, and has become broken up into irregular cords or islands of cells, separated by connective tissue. These are the medullary cords and cor-

respond to the sex cords which later become the seminiferous tubules in the testis. Around the periphery of the organ it is found that a new layer is forming immediately beneath the surface epithelium, this layer being derived from a second proliferation of the surface epithelium, and representing the beginning of the primitive cortical layer. The primitive albuginea layer, previously noted, thus becomes practically obliterated as a definite layer.

This stage represents the earliest phase in the differentiation of the cortical and medullary regions of the ovary. In the ovary it is this cortical layer which, after further growth and development, becomes the active functional part of the organ, while the medullary cords undergo degenerative changes. In the testicle, on the other hand, it is the central portion containing the sex cords, homologues of the medullary cords, which becomes the actively functioning part of the gland, and once the albuginea layer has formed, the surface epithelium becomes inactive and takes no further part in the development of the organ.

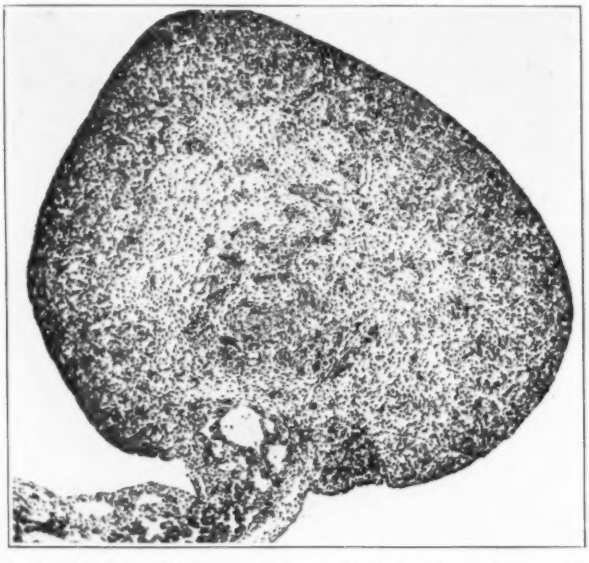

Fig. 8.—Section of ovary from an 80 mm. pig embryo. X75.

No further study will be made of the testis; attention will now be devoted to the further developmental changes which occur in the cortical layer of the ovary.

Embryo 80 mm. (Fig. 8). In the ovary of this specimen we find that the whole organ has increased in size. There is a marked distinction between the cortical and medullary zones. The former has increased very materially and contains a great number of oogonia. The medullary cords have become still further broken up and many of their cells show degenerative changes.

The phases in the development of oogonia into oocytes can now be studied. This begins in the deepermost portion of the cortical layer, gradually extending towards the periphery, so that the differentiation of oocytes may be described as being centrifugal in its progress. In the specimen under consideration we find that this differentiation has begun. At this stage the great majority of the cells in the primitive cortical layer are undifferentiated oogonia with nuclei of the proto-

broque type. These have been constantly increasing in number by proliferation of the surface epithelium, as well as by division and multiplication of the cells thus formed. With the beginning differentiation of oocytes further division of such cells ordinarily ceases. The oogonia in the deepest portion of the primitive cortical layer, after passing through transition stages involving an increase in size, as well as nuclear changes, become oocytes with nuclei of the deutobroque-leptotène type of von Winiwarter. These cells have increased materially in size as have also the nuclei. A fine net-work of chromatin material is to be observed in the nucleus, its filaments tending to converge towards the nucleolus. Another point to observe at this stage is the beginning extension of numerous connective tissue processes from the central portion of the ovary into the primitive cortical

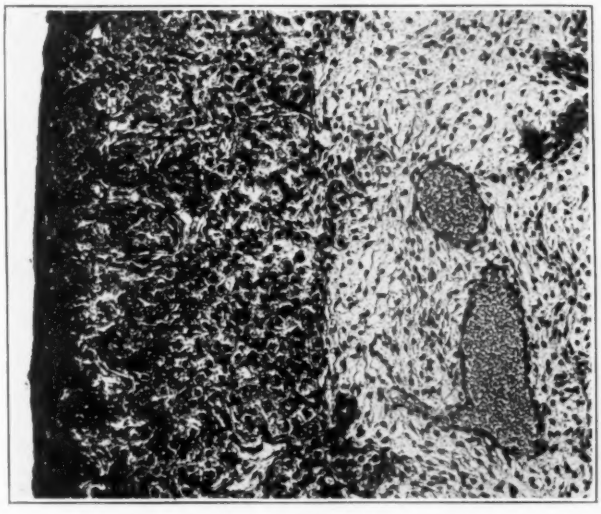

Fig. 9.—Section through primitive cortical zone of ovary from a 90 mm. pig embryo. X140. Note darkly staining nuclei of oocytes in synapsis stage in deeper portion, also "cell nests."

layer. This eventually results in the breaking up of this zone into masses or nests of oogonia and oocytes—the cortical cords or Pflüger's tubes.

Embryo 90 mm. in length (Fig. 9—cortical zone). In this specimen the most deeply lying oocytes have passed beyond the deutobroqueéptotène stage, and are now in the synapsis stage. These oocytes are readily recognized in the print as the most deeply lying ones with large darkly staining masses of chromatin in their nuclei. This is a rather prolonged stage in their development and involves a number of factors. The chromatin of the nucleus assumes a skein-like appearance at one side of the nucleus, the filaments being arranged in pairs. The arrangement of the filaments becomes more dense and they finally appear to become disentangled from the general skein and then spread themselves over the whole nucleus in the form of rather thick threads. External to these are found oocytes in earlier stages of differentiation with nuclei of the deutobroque-

leptotène type, and just under the surface epithelium is a zone in which are still undifferentiated oogonia. The invasion of the primitive cortical layer by connective tissue strands and the breaking up of this zone into "cell nests," which was observed to be beginning in the preceding stage, it now quite advanced. In these "cell nests" are to be found clusters of oocytes in the various stages of differentiation as well as numerous undifferentiated oogonia. The latter are beginning to show a tendency to arrange themselves around the individual oocytes.

Embryo 146 mm. in length (Fig. 10—cortical zone). Marked progress in the differentiation of oocytes and the development of the cortical zone is observed in this stage. In the further growth of the oocytes the nucleus passes from the stage of synapsis to the pachytène type of von Winiwarter, which has an irregular arrangement of the rather thick chromatin thread; this in turn being succeeded by changes resulting in the formation of the diplotène type of nucleus. It is this latter type which is found in the earliest primordial follicles. When this stage

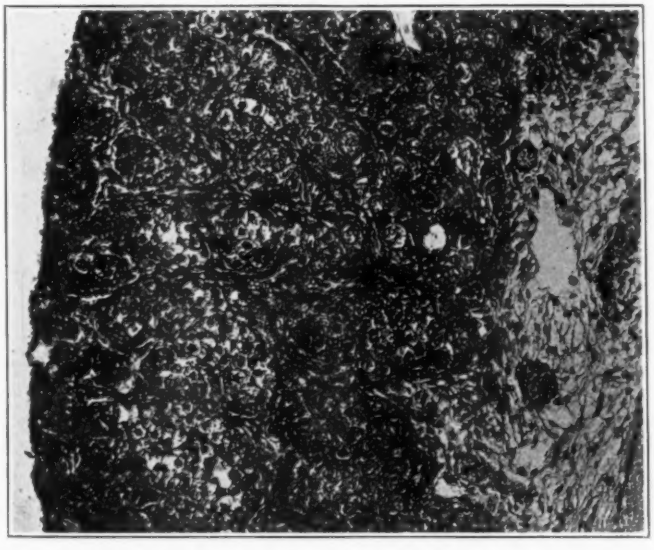

Fig. 10.—Primitive cortical zone of ovary from 146 mm. embryo. X140. Note early primordial follicles in deeper portion, "cell nests" and nuclei in synapsis stage in middle portion.

is reached the oocyte and its nucleus have both increased materially in size, a large nucleolus is to be found and the striking feature is the longitudinal division which the chromatin filament has undergone, so that it now appears as a double thread.

In the specimen under consideration some early primordial follicles containing oocytes in this stage are found in the deepest portion of the cortical layer, some of them entirely, others only partially enveloped by undifferentiated oogonia which are assuming a rather flattened appearance. About the middle of the cortical zone the differentiating oocytes are seen to have reached the synapsis stage, while superficial to this again are to be found oocytes in earlier stages of differentiation, and immediately beneath the surface epithelium a gradually narrowing zone of undifferentiated oogonia. By the further growth of connective tissue the "cell nests" or "cortical cords" are becoming more and more broken up into smaller units in the deeper portion of the cortical layer.

Embryo 200 mm. in length (Fig. 11 low power—Fig. 12 cortical zone). At

this stage a number of fully developed primordial follicles are found in the deepest portion of the cortical layer. In these the oocyte has undergone further development and its nucleus is now of the dictyé type described by von Winiwarter. The oocyte and its nucleus have increased still further in size. The chromatin thread is, however, no longer double, but single, while numerous granules

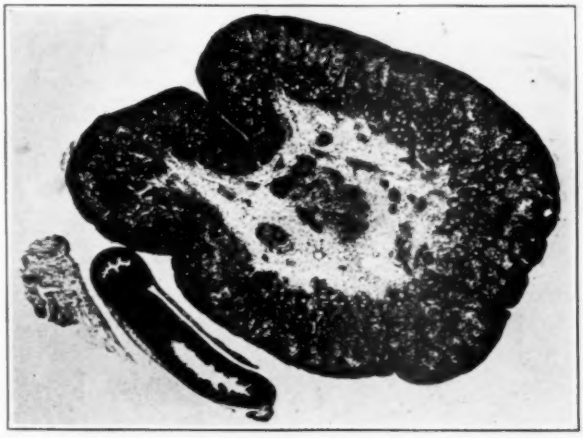

Fig. 11.—Section through ovary of a 200 mm. embryo. X50.

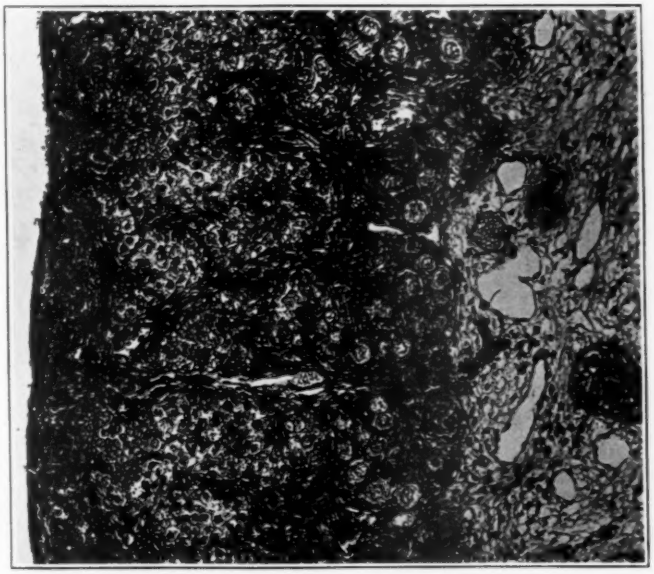

Fig. 12.—Primitive cortical zone of section of ovary shown in Fig. 11. X140.

are to be found. This represents the resting stage of the oocyte as found in the fully developed primordial follicle. Each of these has a covering composed of a single layer of undifferentiated oogonia which have assumed a very flattened outline giving them an appearance quite like connective tissue cells, but having traced the course of events in the earlier stages, and having observed their beginning arrangement around the differentiated oocytes at a time when the oogonia could be definitely identified as such, the nature of the covering of the fully developed

primordial follicle becomes apparent. Further growth of connective tissue has isolated the individual primordial follicles from one another, so that in the deepest portion of the cortical layer we no longer encounter "cell nests." More superficially, well defined Pflüger's tubes are still to be observed, containing oocytes in the earlier stages of differentiation, as well as undifferentiated oogonia. Indeed, in this particular specimen practically all stages in the course of the differentiation of the oocytes, from the oogonia lying just under the surface epithelium to the primordial follicles in the deepest portion containing oocytes with the dictyé type of nucleus, are to be observed.

Embryo 242 mm. in length (Fig. 13 cortical zone). This represents the stage just before birth. Differentiation of the oogonia into oocytes and the formation of the definitive cortical zone with its primordial follicles is almost complete. The ovary of the pig is comparable to that of the human, in that a high state of development is attained before birth. Superficially a few small "cell nests" are found containing oocytes in the synapsis stage and the earlier stages of dif-

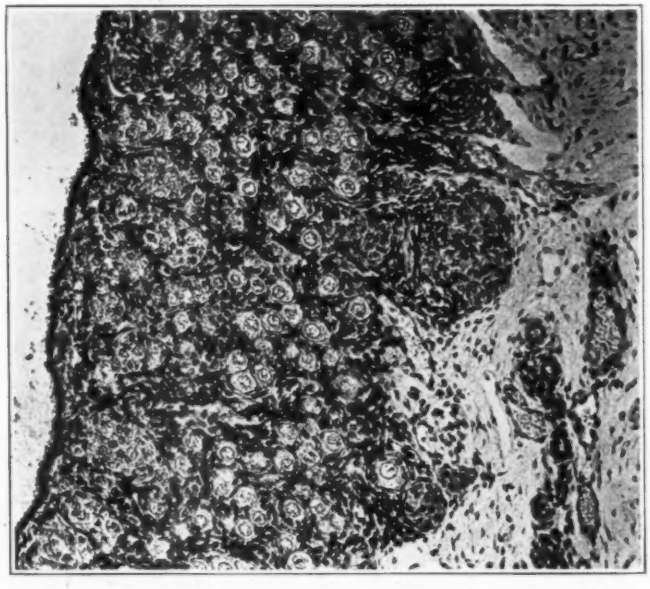

Fig. 13.—Primitive cortical zone of ovary from a 242 mm. embryo. X140.

ferentiation. The zone of undifferentiated oogonia immediately beneath the surface epithelium has almost entirely disappeared and is being replaced by a connective tissue layer,—the definitive albuginea layer of the mature ovary.

A point to which I have not drawn attention in the description of the various specimens, but which should be emphasized, is in connection with the degenerative changes which overtake great numbers of oocytes in various stages of their development. Comparing this stage with the earlier ones it at once becomes apparent from the illustration that the number of egg cells in the cortical layer has very materially diminished. This has been brought about by degeneration of many of the oocytes. This can occur at any period in the course of their development, from the earliest stages up to and including the

primordial follicles themselves. As was pointed out by Clark and Kingsbury this may possibly be due to lack of proper vascular and nutritive supply for the affected follicles or oocytes.

Von Winiwarter states that this is the fate which overtakes all the primordial follicles formed before birth or in early postnatal life, and that in the cat a third proliferation of the covering epithelium of the ovary occurs just before the period of sexual maturity, resulting in the formation of the definitive cortical zone which will give rise to the production of definitive ova. Kingsbury, however, studying the same species doubts the occurrence of this third proliferation. My own material does not permit any statement on this point.

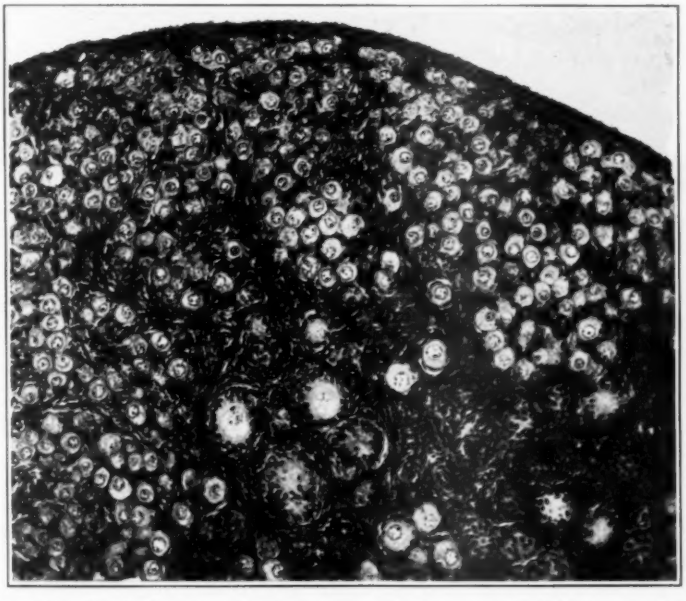

Fig. 14.—Cortical zone of ovary from pig one month old—41 cm. long.

Ovary from pig one month old. (Fig. 14) This stage is on the whole comparable to that of the human infant at birth. The definitive number of primordial follicles is present. Most of them are completely isolated from one another by the connective tissue stroma. In the deeper portions several are found undergoing further development as early graafian follicles. These, however, will doubtless undergo atresia.

SUMMARY

In the pig the genital ridge develops on the inner side of the wolffian body and results from a proliferation of the celomic epithelium in that region, the resulting cells being undifferentiated oogonia. After a time the cells resulting from this proliferation become separated from the surface epithelium by a connective tissue layer. The mass of cells becomes more loosely arranged in cord-like structures—the forerunners of the seminiferous tubules in the male—

the medullary cords in the female. In the male these cords become the actively functioning part of the sex gland. In the female they eventually degenerate.

Sexual differentiation by the histologic picture presented is easily made out at the stage of 22.5 mm.

In the ovary a second proliferation occurs resulting in the formation of the primitive cortical zone, composed in its early stages almost entirely of undifferentiated oogonia. Differentiation of these oogonia into oocytes goes on in a centrifugal direction—the most highly developed ones being found in the deepest portion of the cortical zone. During the course of this process of differentiation, many of the oocytes degenerate. In the pig the process of differentiation and formation of primordial follicles is not quite completed at the time of birth, but is completed early in postnatal life.

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No attempt is made to present a complete bibliography. Only those articles referred to in this paper are presented.

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THE RESULTS OBTAINED IN A CONSERVATIVE TEACHING CLINIC AMONG 2500 NEGRO PATIENTS*

By J. R. McCord, M.D., Atlanta, Ga.

(Associate Professor of Obstetrics and Clinical Gynecology, Emory University)

THIS work was done in the Obstetrical Clinic of the Emory University School of Medicine, Atlanta. The city has a colored population of about 75,000. Our clinic serves the total charity population, which is practically the entire population, and is the only refuge for badly handled cases. Sixty per cent of all negro births reported are cases delivered on our service.

All of the normal cases in our series were delivered by senior students, under the direction of the resident obstetrician. The operative work, in large part, was done by a colleague and myself. The service in our clinic has been entirely indoors for the past several years, enabling us to exercise a closer supervision at all times. All of our obstetrical teaching revolves around two things: the mechanism of labor and conservatism.

At the present time a majority of the cases admitted may be classed as poor surgical risks. Their living conditions are poor, hygiene miserable, food insufficient and poorly balanced. Nearly all of the cases are anemic. Four-plus Wassermanns are present in 30 to 35 per cent of the cases. Oral sepsis, chronic tonsillitis and constipation are the rule. Only 50 to 60 per cent of the cases delivered have attended the prenatal clinic.

DEATHS

The total number of deaths in the series was 61, making a total mortality rate of 2.4 per cent. We think that the following cases should not be counted:

8366—Eclampsia; admitted to hospital delivered and unconscious; in hospital but five hours.

7338—Eclampsia; death two hours after admission.

10—Eclampsia and puerperal sepsis; admitted several days postpartum.

8557 and 8923—Both eclampsia; admitted postpartum.

473—Peritonitis general; frank infection when admitted.

8187—Pyemia; admitted with retained placenta, which was expelled spontaneously; several examinations by a midwife prior to admission to hospital.

7958—Peritonitis general; aborted at five months, prior to admission; temperature when admitted 101 degrees.

5784—Gas bacillus infection; attended on the outside by a midwife and admitted with only the head delivered.

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*Read by invitation before the Forty-ninth Annual Meeting of the American Gynecological Society, Hot Springs, Virginia, May 15, 1924.

4523—Puerperal sepsis; delivered outside hospital.
3415—Peritonitis general; septic abortion; delivered outside hospital.
9—Puerperal sepsis; died twenty-five minutes after admission.
6562—Puerperal sepsis; admitted seven days postpartum.
7659—Typhoid fever.
23—Pernicious nausea and vomiting; in hospital but twenty-four hours.
47—Uremia; four months pregnant and admitted in coma.
3725—Uremia; died thirty minutes after admission.

If we are permitted to omit these seventeen cases, we have a corrected mortality rate of 1.7 per cent. Below are listed some cases that we must accept, but which, we feel, were beyond human control:

Cases 6786 and 6620 both died of puerperal sepsis. The labors were normal, and no vaginal examinations were made. Cases 2630 and 1778 both died of general peritonitis. These labors were normal, and no vaginal examinations were made.

The causes of all deaths were as follows:

Chronic Nephritis	4	Uremia	8
Streptococcemia	1	Lobar Pneumonia	1
General Peritonitis	13	Eclampsia	15
Pyemia	1	Typhoid Fever	1
Puerperal Sepsis	8	Tubercular Peritonitis	1
Gas Bacillus Infection	1	Cerebral Hemorrhage	1
Pernicious Vomiting	1	Ruptured Uterus	1
Cardiac Decompensation	1	Septic Thrombophlebitis	1
Abscess Lung	1	Undetermined	1

It will be noted that throughout this analysis the nephropathies, toxemias and eclampsias are more or less arbitrarily divided. Twenty-seven cases died from these conditions, 44 per cent of the total mortality; 25 cases died from infection, 41 per cent of the total mortality, the two combined giving us a total of 85 per cent of all deaths.

FORCEPS

Forceps were applied forty-one times, an incidence of 1.6 per cent. The maternal mortality was 14.5 per cent, the fetal 14 per cent. Causes of death in the mothers were: eclampsia, two; lobar pneumonia, one; general peritonitis, two; pyemia, one. Indications for interference in these cases follow:

6811—This patient had been horribly burned about the face. Both eyes were completely destroyed. Her deformity was terrible. She had eclampsia, with an R. O. P. position. A Scanzoni operation was done. Patient died of eclampsia.

1074—Eclampsia; multiple pregnancy. The membranes were ruptured artificially. A low forceps operation was done on the first child, a breech extraction on the second. Cause of death was lobar pneumonia.

3802—A low forceps operation was done for eclampsia. The position was normal. Autopsy revealed a marked fatty degeneration of the liver and a cloudy swelling of both kidneys.

3965—This case had a frank infection upon admission to the hospital and a positive smear for gonorrhea. A low forceps operation was done. The patient died of general peritonitis.

8187—Normal position; uterine inertia; low forceps; retention of placenta twenty-eight hours, expelled spontaneously. Cause of death was pyemia.

8917—A low forceps operation seemed indicated on account of eclamptic convulsions. The mother died of a general peritonitis.

Fourteen babies were stillborn, and of this number only one was macerated. Six babies were stillborn of eclamptic mothers. One was stillborn after a Scanzoni operation through a simple flat pelvis. The patient was in labor sixty hours.

A low forceps operation was done for an uterine inertia. The baby was stillborn. Spirochetes were found in the liver. In a case of generally contracted pelvis, a Scanzoni operation was done and the baby was stillborn. One stillbirth was of a nephritic mother, in whom labor had been induced and terminated by a Scanzoni operation.

A stillbirth resulted from a midforceps operation in a generally contracted pelvis. A midforceps was done on a R. O. P. position. Delivery had been attempted outside the hospital. The operations were classified as follows:

Scanzoni	8	Medium	7
High	1	Low	25

Of the Scanzoni maneuvers, four babies were stillborn. Four of these operations were done during the first 600 cases of the series. We are convinced that this operation is technically difficult, dangerous and to be chosen only after very careful deliberation. Eighteen per cent of the forty-one cases had fever during the puerperium.

The indications were:

Pelvis flat	1	Generally contracted pelvis	6
L. O. P. positions	2	R. O. P. positions	2
Eclampsia	6	Uterine inertia	12
Hypertension	4	Maternal exhaustion	1

POSTPARTUM HEMORRHAGES

A very little blood seems like a hemorrhage to the average student. Of the 35 cases indexed as hemorrhages, 28 were delivered by students. Not a single mother in the entire series died of hemorrhage. Two were normal labors, one a placenta previa partialis, the other a hypertension. Our rule in conducting the third stage of labor is to give an ampule of pituitrin as soon as the baby is born, and then let the uterus alone. These cases were arbitrarily divided into the following classes:

Slight	5	Moderate	13
Mild	12	Severe	5

No treatment was required in five cases. The placenta was removed manually three times, and expressed three times. Uterine massage and oxytoxics were used in 20 cases. In only four cases was the uterus tamponed. Three of these cases had fever during the puerperium and one of these was diagnosed as a sepsis. Twenty-eight of the 35 labors were normal.

VERSION, INTERNAL PODALIC

Out of the 10 internal podalic versions done in the series, an incidence of 0.4 per cent, one case was, we think, badly handled. In explanation of the high fetal mortality, 100 per cent, I submit an abstract of every case upon which an internal podalic version was done:

2918—Prolapse of arm and cord, upon admission; transverse; Sc. L. A., fever upon admission; pulse 150; stillbirth; macerated.

3358—Fibroid, right lower segment of uterus; prolapse of cord; toxemia of pregnancy (case badly handled).

6093—Transverse position; Sc. L. P.; prolapsed arm; premature; hypertension. The arm was pulled off by an outside doctor before admission to the hospital.

6817—Transverse; Sc. L. A.; prolapsed arm; Bandl's contraction ring.

7272—Eclampsia; manual dilatation of cervix; hemorrhage postpartum; uterine tamponade.

7684—G. C. pelvis; pre-eclamptic toxemia; artificial rupture of membranes; marginal placenta previa; manual removal of placenta.

110—Placenta previa partialis; postpartum hemorrhage; manual extraction of placenta; sepsis.

1490—Eclampsia; induction of labor (bag); manual dilatation of cervix; third degree tear.

6376—G. C. Pelvis; placenta previa centralis; intrauterine death of fetus; manual removal of placenta.

8057—Hypertension; face presentation.

There was no maternal mortality. Seven cases, 70 per cent, had fever during the puerperium.

INDUCTION OF LABOR

Ninety-two inductions of labor were done, an incidence of 3.7 per cent. The indications for the inductions follow:

Nephritis in 30.4 per cent of the cases; eclampsia in 21.4 per cent; toxemia of pregnancy in 22.4; and pre-eclamptic toxemia 13 per cent.

The maternal mortality was 12 per cent, the fetal, 36 per cent. We believe that labor is more readily induced in the negro woman than in the white woman. Eighty-seven and two-tenths per cent of all the inductions were done for some toxemia. The causes of the maternal deaths follow:

Eclampsia	4
Peritonitis general (both eclamptic)	2
Peritonitis tuberculous	1
Uremia	2
Nephritis Chronic	2

The methods used in inducing the labors were:

Catheter	4	Bag	33
Catheter with rupture of membranes	3	Bag with rupture of membranes	6
Pituitrin	5	Rupture of membranes	4
Castor oil and pituitrin	1	Castor oil and quinine	30
Bag and catheter	3	Castor oil, quinine and catheter	1
Bag and pituitrin	2		

We rarely use the bag now, and of the thirty-three cases mentioned, nearly all occurred early in the series. Forty per cent had fever during the puerperium. Prolapse of the cord occurred twice.

MANUAL REMOVAL OF THE PLACENTA

The placenta was removed manually eighteen times, an incidence of 0.07 per cent. Of these eighteen cases twelve occurred in the first 600 cases of the series. Four mothers died, a mortality of 22 per cent. Fifty-two per cent had fever during the puerperium.

The causes of death were: Cardiac decompensation, 4394; pneumonia, double lobar, 5167; peritonitis, general (badly handled, placenta accreta), 473.

Below are listed the indications for seventeen of the cases:

Cardiac decompensation	1
Postpartum hemorrhage	3
Placenta previa	3
Placenta accreta	1
Lobar pneumonia (retention 72 hours in lower segment)	1
Retention for varying number of hours	3
Generally contracted pelvis, prolapse cord, contraction ring, dead baby, craniotomy	1
G. c. pelvis, R. O. P. Scanzoni	1
Eclampsia, version, craniotomy, dead baby	1
G. c. pelvis, prolapse cord, contraction ring	1
No indication	1

RETAINED PLACENTA

In thirteen cases the placenta was retained for more than three hours. The time in hours each was retained was: 96—72—4—48—28—72—72—36—8—48—4—3. Seventy-six per cent of the cases had fever during the puerperium. Four mothers died, a mortality of 31 per cent. The causes of death were:

473—Retained 72 hours, 6 months' baby, manual removal, placenta accreta, hemorrhage, tampon, puerperal sepsis.

8187—Five examinations by midwife, inertia, low forceps, placenta retained 28 hours, spontaneous expulsion, pyemia.

5167—Placenta retained 72 hours, manual removal, lobar pneumonia double.

4405—Septic abortion (incomplete), delivered outside, retained placenta 72 hours, removed with sponge forceps, general peritonitis.

In six of the thirteen cases the placenta was expelled spontaneously. It was removed manually three times and expressed once. Manual dilatation and extraction was done once, and instrumental re-

moval twice. Seven of the cases were incomplete abortions; two had postpartum hemorrhages; seven had outside manipulation. The uterus was tamponed two times. One case developed sepsis, another general peritonitis. Three were premature labors.

CESAREAN SECTION

Seven cesareans were done, an incidence of 0.28 per cent. Two mothers died, making a maternal mortality of 28.6 per cent. One baby was known to be dead when an extraperitoneal cesarean was done for a generally contracted pelvis, after attempts to deliver from below had been made. This case might have been better had it been handled differently. This case also gave us 50 per cent of our mortality, dying of a septic thrombophlebitis. The other death was caused by streptococcemia. The pelvis was generally contracted, patient was in labor ninety hours, exhausted, membranes having been ruptured twenty-four hours. The position was an R. O. P. and Beck's operation was done. The other babies were delivered in good shape. The indications with the type of operation were:

Intraligamentous cyst, premature rupture membranes, test of labor	Beck's operation
Generally contracted pelvis, 90 hours' labor, exhaustion, membranes ruptured for 24 hours, live baby, R. O. P. position	Beck's operation
Flat pelvis, former section for eclampsia	Classical, with high incision
Cerebrospinal syphilis, convulsions, primary uterine inertia	Classical, with low incision
Eclampsia	Classical, with high incision
Eclampsia (twin pregnancy)	Classical, with high incision
Prepartum infection, g. c. pelvis, attempt high forceps, craniotomy	Extraperitoneal

We have been criticized on account of undue conservatism. The negress is usually a poor surgical risk, particularly in acute toxemias. At the present time we do not regret our conservatism.

TAMPONADE OF UTERUS

The uterus was packed in ten cases. Two mothers died, a mortality of 20 per cent. Eight of these ten cases had fever during the puerperium. In five of them the placenta was removed manually. The causes of death were: cardiac decompensation and puerperal sepsis (placenta accreta).

INDICATIONS AND COMPLICATIONS

Hypertension	3	Manual dilatation cervix	2
Uterine inertia	2	Manual removal placenta	5
Eclampsia	1	Scanzoni forceps	1
Abortion	1	Hemorrhage postpartum	5
Retention placenta	2	Forceps low	2
R. O. P. position, g. c. pelvis	1	Sepsis	2
Placenta previa	1	Placenta accreta	1
Version internal podalic	2	Prematurity	2

MANUAL DILATATION OF THE CERVIX

Of the seven cases in which the cervix was dilated manually, or rather in which the dilatation was completed, one was an abortion, one a partial placenta previa and five pregnancy toxemias. The incidence was 0.3 per cent and the maternal mortality 33 per cent; one mother died of eclampsia, the other of uremia. Omitting one abortion, in the remaining six cases there was not a single live birth. The results were so poor, that all seven cases are abstracted below.

249—Abortion, retention of placenta two days, slight dilatation of cervix and placenta removed from lower segment.

3141—Eclampsia, multipara, premature rupture of membranes, delivery not completed, death of mother and baby (uremia ?).

3559—Toxemia of pregnancy, transverse position, fever, para v, manual dilatation of cervix, death of mother in two hours, stillbirth.

7272—Eclampsia, manual dilatation of cervix, internal podalic version, hemorrhage, tampon, fever in puerperium, stillbirth, recovery of mother.

110—Placenta previa partial, manual dilatation of cervix, internal podalic version, hemorrhage, manual removal of placenta, tampon, puerperal sepsis, stillbirth, recovery of mother.

1490—Eclampsia, induction of labor (bag), manual dilatation of cervix, internal podalic version, fever in puerperium, third degree tear, recovery of mother, stillbirth.

5036—Eclampsia, induction of labor (bag), manual dilatation of cervix, internal podalic version, manual removal of placenta, recovery of mother, stillbirth.

CRANIOTOMIES

Two craniotomies were done on living babies:

1378—Early rupture of membranes; many examinations by midwife; twelve hour test of labor in hospital; g. c. pelvis; forceps attempted on floating head; craniotomy on living child; death of mother; septic thrombophlebitis.

8735—A large semicystic tumor of the neck; size of fetal head was obstructing labor. A craniotomy was done on the living baby as the only way to effect delivery.

These 2500 cases are the results of the first teaching prenatal clinic for negroes in the Southeast. The Clinic has proved so acceptable to the negro population, that 60 per cent of the reported negro births are from this Clinic.

The mortality rate is high, but when one considers the disease, poverty, ignorance and unsanitary environment in which the patients live, a gentler judgment is probably justified.

The material is so abundant, the complications and pathology so varied, that its influence upon the teaching of obstetrics in this section of the country is almost invaluable.

EMORY UNIVERSITY, ATLANTA, GA. (*For discussion see page* 779.)

A FURTHER STUDY OF THE ORIGIN OF UTERINE BLEEDING IN TUBAL PREGNANCY*

By John Osborn Polak, M.D., and Samuel A. Wolfe, M.D.,
Brooklyn, N. Y.

IN 1921, before the American Association of Obstetricians, we presented a preliminary report on the study of the origin of uterine bleeding in tubal pregnancy. In this paper we drew an analogy between intrauterine pregnancy and tubal gestation; and showed that there was no uterine bleeding in either until threatened abortion occurred or rupture of the tube took place.

In continuing this study in 65 recent cases of tubal pregnancy, we have been impressed by the persistence of vaginal bleeding following the removal of the gestation sac; therefore, it occurred to us that routine curettage (except in urgent cases) prior to salpingectomy, might indicate in a relative way, when the uterine findings were correlated with the clinical history and the findings in the tube; the probable time of the death of the ovum—and also help to explain the cause of vaginal bleeding in ectopic. The presence of decidual elements would indicate a living or a very recently destroyed ovum.

In 20 cases, postoperative uterine bleeding persisted for periods varying from a week to 15 days following the removal of the tube with its contained pregnancy—in 5 of these cases the uterine cavity was subsequently curetted—and some of our deductions are based on these findings.

The question therefore arises, as to how this vaginal bleeding can be explained—is this bloody discharge the effect of subinvolution as shown by Sampson or is it a result of the erratic decidual formation within the uterus which desquamates and is cast off in shreds in the vaginal discharge?

In both intrauterine and extrauterine pregnancy, the coverings of the ovum are the same—the chorion possesses the same trophoblast producing cytolysis of the cells of the mucosa and burrows its way either into a fold of the mucosa, or between adjoining folds which usually surround the ovum until it finally rests upon the subepithelial layer of the muscularis.

Unfortunately the decidual reaction in the tube owing to its scant stroma is incomplete, scattered and scanty, and does not protect the muscularis from invasion, as does the more perfectly formed decidua within the uterus, hence the dilated vascular and lymph spaces are

*Read at the Forty-ninth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 15-17, 1924.

exposed to the direct erosive action of the covering cells of the villi as the ovum imbeds itself in the tubal wall.

As this erosion takes place into the large tubal vessels and the venous radicals are invaded, an effusion of blood far beyond the needs of the fetus occurs, and this hemorrhage crowds the intervillous spaces with blood, irritates the muscle, provokes contraction and disturbs the implantation of the ovum or may rupture through the internal or external capsule and interrupt its further development.

On serial section, if the ovum is alive, one occasionally finds islands of decidual reaction, not only near the point of implantation and in the uterus, but even in the other tube. This is identical with the decidual reaction found in the unpregnated horn of a uterus didelphys with pregnancy in the other horn.

Therefore, it will be seen that the chief difference between imbedding in the uterus, from that of imbedding in the tube, is the thick decidua which is found in the uterus and the scanty, scattered, nonprotecting decidual reaction which is found in the tube.

Furthermore, as has been shown by Sampson's injected specimens, the vessels in the uterus with which the trophoblast comes in contact, are terminal radicals of very small size, while in the tube the vessels are very much larger and because of the penetration of the villi into the muscular layer of the tube, the hemorrhage is greater. Hence the seat of the ovum is unsettled and gives rise to attacks of tubal colic and uterine bleeding—again, the uterine muscle is capable of stretching and hypertrophy, and thus more easily accommodates itself to the growing ovum. This occurs in interstitial pregnancy; while in the tube the edematous and hemorrhagic muscle wall has its limitations. The growing ovum, especially at the point of placental development distends and weakens the tube, and the blood which fills the intervillous spaces bursts through into the ovular capsule at its thinnest point, namely, toward the lumen and separates the ovum from its bed to a greater or less extent.

These changes explain the frequency of tubal abortion, the fact that these abortions are often incomplete and the development of the embryo faulty, while the trophoblast may continue its erosive action and still maintain an impaired circulation in the ovum.

Clinical and pathologic observation has shown that the development of a tubal pregnancy always produces a decidual reaction in the endometrium of the uterus, similar to, but not so extensive as that which develops in a normal pregnancy; and that the uterus enlarges to a greater or less degree as the tubal pregnancy progresses.

The possibilities of this line of investigation are well shown in these four illustrative cases, recently seen in the gynecologic service of the Long Island College Hospital.

CASE 1.—Mrs. M. L. was seen in the outpatient service on March 24, 1924, complaining of vaginal bleeding and pain in the left lower abdomen. Menstruation began at thirteen, no irregularities were noted until present illness. Last period from February 17 to 22, 1924. March 10, spotting began; on the 17th, bleeding became more profuse and was associated with pain in the left lower abdomen with a feeling of faintness.

There was definite tenderness in the left lower quadrant; vaginal bleeding was present; cervix tender to motion, and a tender mass filled the left lower quadrant; a shaggy uterine cast projected from the patent cervix which was removed with ease (the microscopic features, typical of an endometrial decidua, are well shown in the photomicrograph, Fig. 1). Hospital treatment was refused by the patient at this time. Following separation of the cast, vaginal bleeding ceased for six days, but the pain persisted. On April 12, bleeding recurred associated with severe colicky pain in the left lower abdomen. The patient was admitted as an

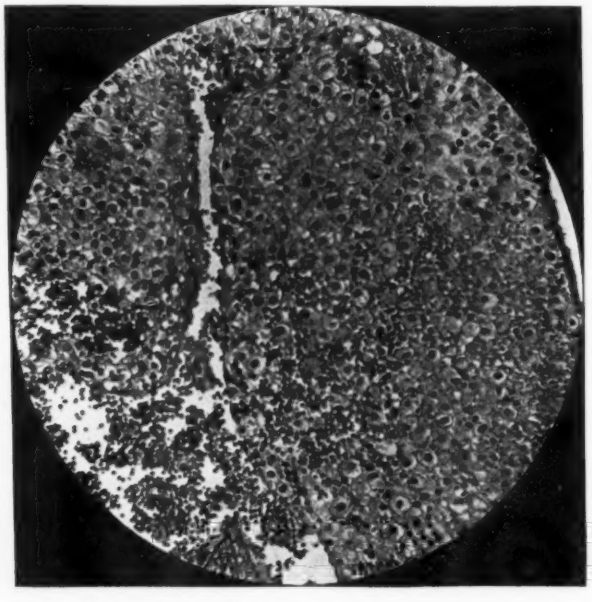

Fig. 1.—Case 1, (11,198) X20. Decidual cast of uterus. Its separation and expulsion demonstrate one mechanism of vaginal bleeding in ectopic gestation.

emergency ectopic to a city institution and immediately operated. The specimen, unfortunately, was not conserved for complete study. The pathologist reported "old tubal abortion."

Summary.—Three weeks before operation a decidual cast was separated and spontaneously expelled from the uterus. At operation "old tubal abortion" was found. From the history the cast expulsion followed one week after effects of tubal abortion, as noted clinically by the onset of cramps in the left lower abdomen.

CASE 2.—Mrs. V. R. was admitted to the Long Island College Hospital on April 7, 1924. Menstruation began at fourteen, twenty-eight day type, four to five days, always regular. Married three years, never pregnant. Last period from February 16 to 20. Present illness dates from March 16. On that date

her period began, but the flow was more marked than usual (the duration increased to two weeks) and associated with abdominal cramps. From March 31, to April 6, no pain or bleeding; on the seventh, symptoms reappeared and patient was admitted to the hospital. Examination revealed tenderness in both abdominal quadrants; a tender cervix; vaginal bleeding and tender mass in the right lower quadrant. A diagnosis of ectopic gestation was made and operation performed on the 8th. The curettings and tube are reported as follows:

(a) *Tube*—The organ is enlarged in both its diameters and is 15 cm. long and 8 cm. wide. The uterine end presents a circumscribed enlargement, 25 mm. long and 10 mm. wide; the remainder of the tube is regular and symmetrical. The enlargement is the result of interstitial implantation of an ectopic gestation. A rent in its antero-inferior aspect has resulted in bleeding into the broad ligament, as well as into the peritoneal cavity. On gross cut section through this zone, the enlargement is seen to be the result of distention of the lumen by blood clot; the tubal wall proper, except in its inferior aspect, is thin, atrophic and hemorrhagic. Even with the naked eye the placental villi can be seen lodging in the tube wall. At the distal extremity the lumen is dilated and filled with blood, but except for edema the muscle wall is normal. Section through the ampulla and infundibulum shows a thickened mucosa with prominent folds. The tube lumen is free from blood; the fimbriae are almost completely retracted, just the tips projecting beyond the almost completely occluded abdominal ostium.

Microscopic Examination—Section through the anlage of the ectopic gestation reveals a tube lumen filled with clot and chorionic villi, only few are well preserved; most have lost their lining epithelial cells and the connective tissue stroma has undergone necrosis leaving a granular mucoid mass to mark the site.

Even where Langhans' and syncytial layers are retained the stroma shows mucoid degeneration. The inner tube wall has been destroyed and replaced by blood, fibrin and leucocytes. No traces of mucosa are present. Chorionic villi can be traced to the muscularis, and at the site of contact extensive fibrinoid degeneration has followed. Anteriorly and superiorly the wall is represented by a few edematous strands of muscle tissue in a state of hydropic degeneration with round cells; blood and neutrophiles in the interstices. Posteriorly, the wall is fairly well retained and seems thicker than usually encountered in the tube, confirming the gross diagnosis of a true interstitial pregnancy. Here too, however, the muscle is edematous. More distally through the site of implantation the lumen is better defined, but filled with blood clots and degenerated villi. The mucosa is lacking, and even here, the superficial muscle layers are hemorrhagic. The tube wall is edematous and atrophic. In the infundibular region, the lumen is narrowed by large, widely arborizing mucous folds lined by hypertrophic epithelial cells and supported by a dense, sclerotic stroma. The musculosa, even here, is edematous. A moderate number of lymphocytes are present between the fibers. The blood vessels are engorged but reach maximum size in the serosa. Here the exudation of round cells is most marked, and about the blood vessels is very compact. These changes are indicative of a subacute inflammatory salpingitis of an interstitial type. No decidual reaction was found on serial section.

(b) *Curettings*—These are abundant, the fragments are large and thickened, reaching 4 mm., 6 cm. in thickness; the surface cell lining is lacking in all fragments. The gland tubules are normal in number but moderately increased in size; their shape is round or oval, the lumen filled with secretion. The lining cells are irregular and ragged against the lumen; though the cell *per se* is hypertrophic and holds a large oval nucleus basally placed, the stroma is compact. The cells are enlarged, round or oval in shape with abundant acid cytoplasm and a vesicular nucleus. About the blood vessels these reach sufficient size and are still

well enough preserved to be considered as true decidual cells; elsewhere, the cells are smaller, polypoid or oval in shape with a pycnotic, small, solid nucleus (Fig. 2). In one zone, restoration to long spindle cells has occurred; many show mitotic figures. In general, the impression is that of regressing decidual cells. The

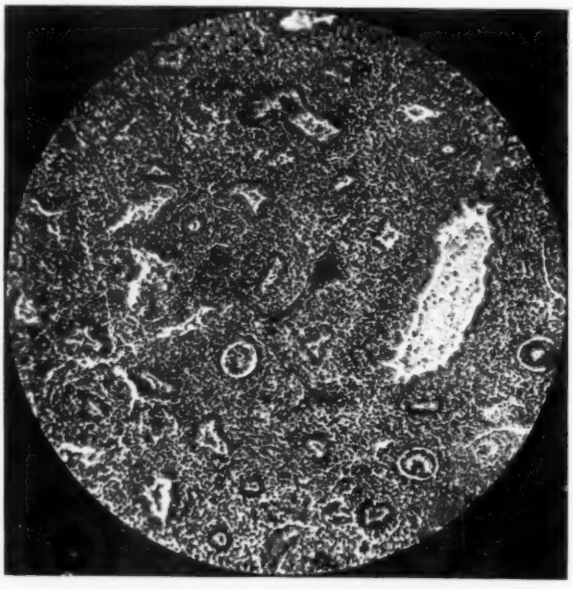

Fig. 2.—Case 2, (11,243) X20. Uterine curettings from case of ectopic gestation. The glands correspond to those of the internal mucosa, the capillaries are engorged and prominent, the stroma compact. Bleeding from the engorged vessels represents another mechanism of vaginal hemorrhage in ectopic gestation.

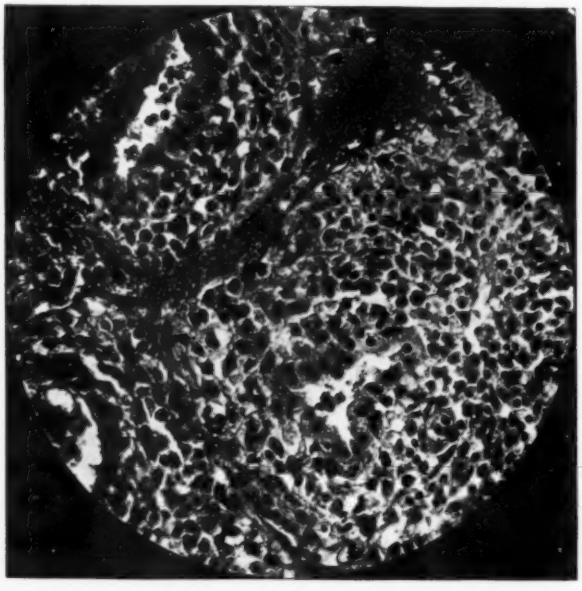

Fig. 3.—Case 2, (11,243) X80. Uterine curettings. The engorged capillary is prominent. The stroma cells are large, round, and prominent though the gland is of the internal type.

capillaries are numerous and engorged (Fig. 3). In some foci interstitial hemorrhage is present. An occasional lymphocyte is encountered. These features are well shown in the accompanying photomicrographs.

Summary.—In this case there is no clinical evidence of decidual separation and expulsion, yet curettage revealed a regressing decidua; unless specifically searched for, its occurrence would not have been suspected. In the absence of hemorrhagic changes in the mucosa and its failure of separation, it is fair to conclude that bleeding proceeded directly from the oval site in the interstitial portion of the tube, directly into the uterine cavity and then into the vagina. The receding decidua is in accordance with the advanced degeneration of the chorionic villi.

Clinically, ectopic tubes removed at operation demonstrate in 75 to 80 per cent of the cases, tubal abortions with a history of bleeding from weeks to months. Except for an occasional hemorrhagic mole the ovum has been detached from its site and lies either free in the tube or expelled with blood clot into the peritoneal cavity. In these "old dead ectopics" decidual separation and expulsion or regression must have been long past, yet bleeding per vagina persists until the tube is removed. Curettings in these instances cast considerable light on the mechanism of the bleeding as indicated by the next two cases.

CASE 3.—Mrs. M. R. was admitted complaining of persistent vaginal bleeding and pain in the right lower quadrant. Menstruation began at thirteen and recurred regularly every 28 days, three to four days in duration. Married five years Normal labor four years ago. Not pregnant since. Last period from November 29 to December 2, 1923. On January 8 and 9, 1924, the patient began to spot and she noted shreds of soft grey material in the brownish discharge (probably decidual endometrium).

On the 14th, the bleeding became more profuse and was associated with right-sided pain. Pain and spotting persisted until admission on January 26. Prior to salpingectomy on 29th, a curettage was performed. The fragments are moderate in amount but glary and edematous. On microscopic examination the findings show a normal surface layer. The uterine glands are increased in size, and since cut transversely, are round or oval in shape. Inclusion forms are numerous; the lumens are filled with secretion or collections of hemolized red blood cells. The lining cells have tall nuclei which are enlarged and hyperchromatic. The cyclic phase is not typical. The stroma is markedly edematous and irregularly scattered throughout; in some foci preservation has been complete. The capillaries are engorged; several running perpendicularly to the surface have assumed the proportions of actual sinuses. On laparotomy the right tube was found converted into a typical hemotocele. The right ovary contained the regressing corpus luteum. Serial sections of the tube failed to reveal the presence of decidua. The microscopic findings show the usual clot within the lumen with compression of the mucous folds, edema and atrophy of the muscularis. Only in the ampullar region are few well preserved chorionic villi encountered lying free in the lumen. The interstitial hemorrhage in the mucularis confined to the same tubal zone most likely indicates oval implantation in this zone. No other changes are noteworthy.

CASE 4.—Mrs. F. W. began her menstrual life at thirteen. Periods occurred regularly every 28 days and continued three days. There was no change after

marriage or previous to childbirth. The last period continued from September 28, to October 1, 1923. On October 28, menses recurred and continued very profusely with clots for two weeks. The next two weeks bleeding continued with daily spotting. On November 28, the bleeding recurred freely and was associated with pain in the right lower quadrant. Pain and spotting continued until admission on Dec. 11. Operation was performed on December 13. Curettage preceded right salpingectomy. The microscopic features are as follows:

The surface lining cells present no abnormality. The tubules are not sharply defined to a zone, though a basal layer of unaltered glands in a spindle stroma can be differentiated. The tubules are normal in size; round, or oval, or slightly tufted; occasional inclusion forms are seen. The lining cell is tall with abundant cytoplasm and a basally placed oval nucleus. The cell border is sharply defined against the lumen which in nearly every instance contains red blood cells. The

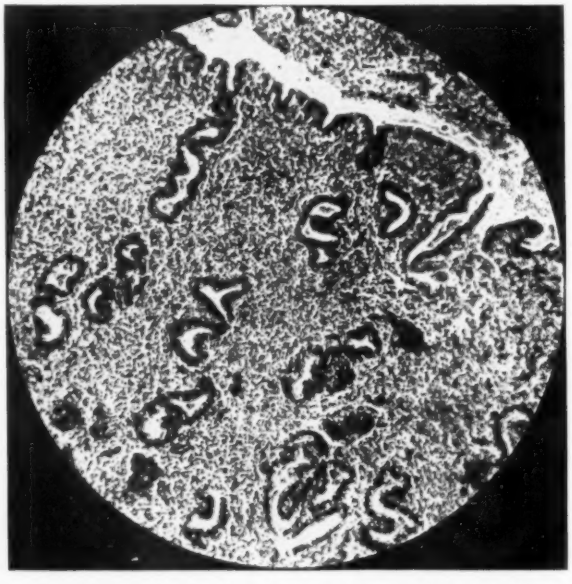

Fig. 4.—Case 4, (10,883) X60. Uterine curettings from ectopic pregnancy. The glands correspond to the late interval type. The stroma is diffusely infiltrated with red blood cells.

stroma has been converted from a spindle to the round cell form, but no decidual elements are present.

Throughout interstitial hemorrhage is present and near the surface is dense and compact, reminding one of a premenstrual mucosa though the gland contour is not typical of this phase (Fig. 4).

The right tube shows a dead ectopic, projecting from the abdominal ostium. The isthmus portion is normal.

On multiple gross sections the ampular and infundibular areas are found filled with clots which could be easily shelled from the dilated tube. Serial sections of the tube fail to show presence of decidual cells. The clot in the tube lumen contains well preserved chorionic villi. The mucosal papillae are flattened in the long axis of the tube. The lining cells are normal but the stroma contains engorged vessels. The muscle coat is thin and edematous. The serosa is normal but the blood vessels are congested.

In the last two cases, only an occasional villus is found in the tube even after serial section study. In keeping with complete ovular separation, no decidua is found in the uterus. The uterus is clothed by an interval type of endometrium with marked interstitial hemorrhage and markedly engorged vessels.

The injection experiments of Sampson on uteri with associated ectopic gestation demonstrated the passage of the injection medium from the capillaries to the uterine cavity.

The microscopic features in these cases are in keeping with his experiments. Subinvolution of the uterus persists until the ectopic has been removed.

This study has shown:

(a) Majority of tubal pregnancies are incomplete tubal abortions which are not completely terminated at the time bleeding occurs; and that vaginal bleeding persists as long as the ovum is alive and partially attached to its tubal bed.

(b) That many cases are operated before the ovum dies. In these, decidual reaction is found in tube and uterus.

(c) In those operated after death of the ovum, no decidual reaction is found.

On opening the abdomen in cases of unruptured pregnancy it is not uncommon to find blood escaping from the free end of the tube into the culdesac of Douglas; and in some of our cases, where erosion has caused porosity of the tubal wall, we have found blood escaping through the tubal wall, and yet, at this time, there had been no bleeding from the uterus.

On the other hand, in cases where we have removed the tube, hardened and sectioned it, and have found the ovum separated from its bed by blood clot, there has always been uterine hemorrhage.

We, therefore, must conclude from this clinical observation: that uterine hemorrhage is a sign of threatened tubal abortion; that many of these cases are operated upon before the abortion is terminated; and that, therefore, there are islands of decidua in the uterus which must be separated and cast off. This explains the persistence of uterine hemorrhage which continued after the tube with its contained pregnancy was removed.

In the microscopic study of the curettings we find decidual reaction in the uterus, as long as the ovum in the tube is alive, and the pregnancy is not terminated either by the removal of the tube, or the death or expulsion of the ovum.

In the majority of cases of tubal abortions, however, the endometrium shows nothing but a hemorrhagic interval mucosa; the bleeding, however, continues in about a third of the cases until the tube with its contained pregnancy is removed and the uterus gradually

undergoes involution. The tube, in these cases, when examined microscopically, shows an absence of decidual reaction, evidencing fetal death.

We feel, therefore, that it is safe to state that vaginal bleeding in the early phase of ectopic is the result of the death of the ovum. The bleeding proceeds in this instance from the endometrium as a result of the separation of the decidual cast, and, because of the erratic distribution of the decidual reaction in many cases, persists for days after the ovum dies or is removed.

(a) Many times decidual reaction in the uterus of ectopic occurs when not suspected. Routine curettage will show its true incidence of frequency.

(b) In interstitial pregnancy, vaginal bleeding may be due to the direct entrance of blood from the tube into the uterine cavity.

(c) The bleeding, if the tubal abortion is incomplete, is a result of persistent engorgement of the restored endometrium in which interstitial hemorrhage occurs with resulting vaginal bleeding, following rupture of the dilated vessels.

Some few cases in which the bleeding persisted for a considerable period after the ectopic had been removed, were curetted and the curettings examined. In these, nothing was shown except the hemorrhagic interval mucosa, hence we believe that uterine involution is slower after ectopic pregnancy than after intrauterine gestation.

20 LIVINGSTON STREET.

(*For discussion see page* 783.)

A CLINICAL CONSIDERATION OF THE CONTRACTED PELVIS*

By H. C. Burgess, M.D., F.A.C.S., Montreal, Canada

PRIVILEGED to attend for a number of years the routine work of a teaching maternity hospital, I have been greatly impressed by the importance of the contracted pelvis.

As one observes the emergency work of this kind that enters the hospital, the conclusion that forces itself upon one is, that the fatal result to the fetus and the injury to the maternal soft parts are not due so much to an operation technically badly performed, as to the selection of an ill-advised method of delivery.

If this conclusion is a correct one, it becomes highly necessary to ascertain why this condition exists, and I believe it arises from the complex classification of the pelvis employed at the present time, a classification that is rarely, if ever, grasped by the student during his college course, and never retained by the practitioner in after life as a working basis.

A study of the 1,935 cases of contracted pelves that entered the Montreal Maternity during the years 1906-1923 inclusive, shows them to be divided into thirteen varieties.

A review of the records of these cases, however, based on a larger experience, shows that it is possible, with the exception of a few imported into this country from Central Europe, to subdivide them into four divisions.

The first is the generally contracted pelvis (Fig. 1). It is not a deformed pelvis in any particular. Proportionate to the rest of the body, it fails at times obstetrically, owing to the fetus attaining its paternal characteristics.

The second is the masculine type of pelvis (Fig. 2). Assuming that its features in early fetal life, as suggested by Fehling, possibly are a secondary sex change influenced by the endocrine system, one notes in adult life the prominent muscular attachments, the heart-shaped brim, the deep pelvic cavity, the subpubic angle, and the narrow bis-ischial diameter.

The third group is the rachitic, or nutritional type (Fig. 3). The simplest variety is the flat pelvis, and from this we progress to a flaring of the iliac spines and a widening of the pelvic outlet. The more serious varieties give rise to marked pelvic contraction in one or more diameters, and often make impossible the normal birth of the fetus.

*Read by invitation at the Forty-ninth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 15-17, 1924.

The fourth group is the result of conditions usually without the true pelvis, and one notes the pelvic deformity caused by a tuberculous hip (Fig. 4), by caries of the vertebra (Fig. 5), or by a pelvic tumor (Fig. 6), etc.

A review of the last 13,158 patients that entered the Montreal Maternity and whose pelvic measurements were taken, shows that 1,935 had contracted pelves, and of these 622 were generally contracted, 509 were rachitic, 398 were masculine, and 18 were diseased.

It is not my intention to minimize the monumental work that has been accomplished by anatomists and obstetricians in the past on the various types of contracted pelvis, but from a clinical consideration a definite advance can be made if the differences (if any) between a

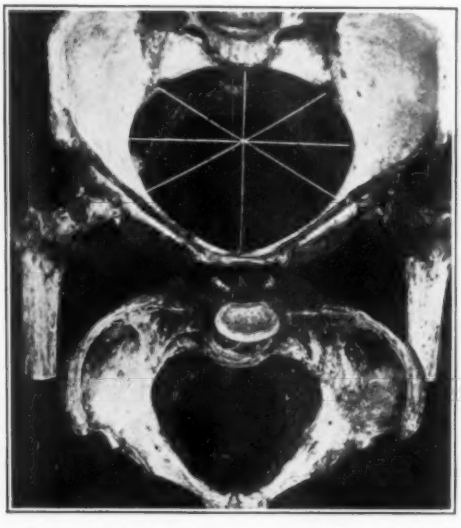

Fig. 1.—Normal pelvis (above). Generally contracted pelvis (below).

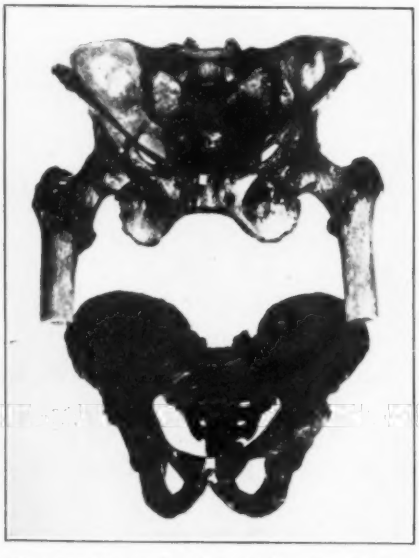

Fig. 2.—Normal pelvis (above). Masculine pelvis (below).

generally contracted and a justo-minor pelvis can be swept away, if it is admitted that a flat pelvis is always a rachitic one, and that funnel pelves are closely related to a masculine type. Especially is it an advance when one realizes that for the next quarter of a century at least, the great majority of obstetrical cases in this country will be attended by the general practitioner, and that better work will be done if he is shown that a simple classification such as I have given you, will meet his everyday wants.

While I would simplify the working knowledge necessary for a classification of the pelvis, I would urge that more time be spent in the discovery of this condition.

The more careful taking of the anamnesis, the better general phys-

ical examination, and the more detailed study of the pelvis, will all lessen the disastrous results at the end of pregnancy.

A careful inquiry into previous labors will give a very valuable index as to the probable course of labor in the succeeding ones.

If her labors have been easy or terminated by natural methods, the probability is that this woman's pelvis is large enough to allow the safe journey of another passenger through the tunnel, always remembering that with each succeeding pregnancy the passenger will be a little more bulky, and a little more tardy in undertaking the journey.

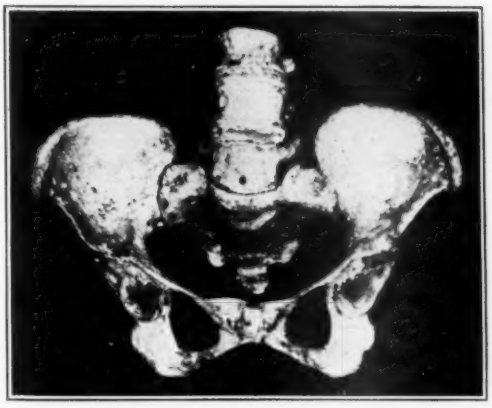

Fig. 3.—Rachitic pelvis.

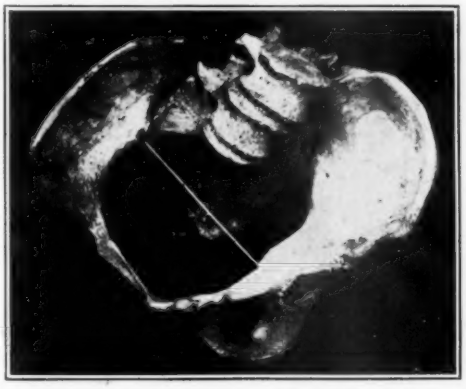

Fig. 4.—Deformed pelvis from hip-joint disease.

If, on the other hand, the labor has been difficult, protracted, or delivery has been instrumental, it is our duty to discover the cause and take precautions before the next labor takes place.

The early history of the life of the individual will be of the greatest benefit; the age at which she first walked, the history of any severe illness or accident, the history of dystocia in any other member of her family, may all give us the clue to impending disaster, and so put us on our guard.

Need I mention the great value of a careful general physical examination? How often the generally contracted pelvis can be more than suspected by the woman's size, the delicate mold in which she has been cast. The presence of a large head, the rachitic rosary on her chest, the bow legs, the thickened extremities of her long bones,

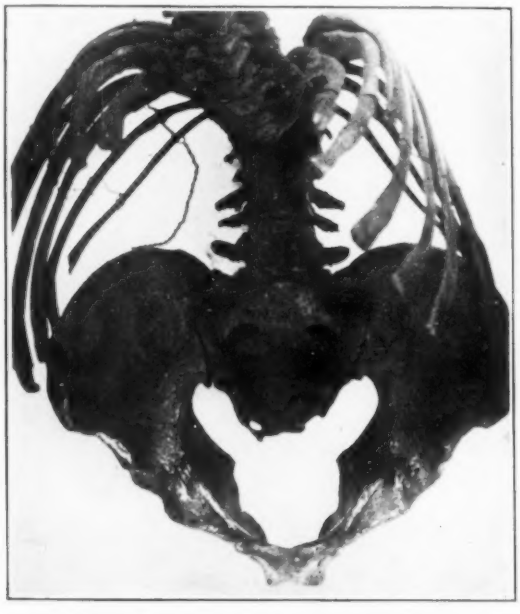

Fig. 5.—Deformed pelvis from spinal disease.

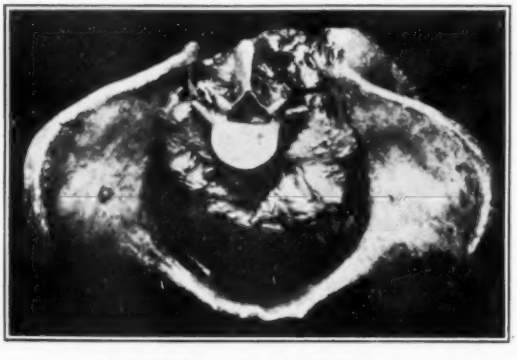

Fig. 6.—Bony tumor of pelvis.

may all give a clue to the rachitic pelvis; while the shoulders, the hips, the contour of her lower extremities, the orientation of the hair on her lower abdomen and thighs, spell the passing over of that individual from a female to a male type.

The third method of diagnosis depends on the examination of the patient, especially the primipara, in the last month of her pregnancy.

"Does the size of the uterus correspond to the period of amenorrhea?" is a question that should never be forgotten by an obstetrician. Almost of equal importance from an obstetrical point of view is an answer to the question, "In the primipara, has the head engaged in the last month of her pregnancy?"

If it is answered in the affirmative, it means that for that individual the worst part of her labor is over, and one can usually give her the assurance that her labor will be terminated satisfactorily. If, on the other hand, the head is not engaged, it means usually disproportion between the fetal head and the mother's pelvis and the examination must be carried a great deal further.

The formation of a pendulous abdomen means a failure of the head to enter the pelvis and clinically is of great diagnostic value.

After having ascertained the presentation and position of the fetus and estimated its size, we next turn our attention to the size and characteristics of the mother's pelvis, and here certain measurements are of the greatest value, and when once understood are not difficult to take, or to interpret.

The measurements are divided into what are known as the external and internal measurements.

By the external measurements we measure the false pelvis and then calculate the size of the true pelvis.

The measurements taken are four in number: the intraspinous, intracristal, intratrochanteric and the external conjugate or Baudelocque diameter, and they measure in this order, 26, 29, 31, 21 cm.

Personally I attach the greatest importance to these measurements, and I firmly believe there are very few occasions in the practice of medicine where one can argue as accurately as from these findings, yet probably no diagnostic help is ignored more completely.

In an effort to prove the value of these measurements, especially the external conjugate, we reviewed a series of two thousand cases, and found that where the external conjugate measured 20 cm. or over, one case in ten required operation, while if the Baudelocque diameter was contracted down to 17 or 18 cm. the number of operated cases had advanced to the proportion of 1-3.75 (Chart I). If the pelvis is contracted and further study is desirable, the patient is put in the lithotomy position and the diagonal conjugate is measured; then by subtracting 1.5 or 2 cm. the true conjugate can be estimated.

A review of 2,000 cases at the Montreal Maternity shows that in 1,881 cases where the C.V. was 10.5 cm. or over, all cases delivered themselves spontaneously, while if between 8.5-7.5 cm. then one case in three demanded surgical interference.

From a study of these cases one can safely say that where there is a shortening of the true conjugate, there is practically always a shortening of the external conjugate, but there may be a shortening of the

CHART I

THE MONTREAL MATERNITY HOSPITAL
SERIES OF 2,000 CASES.

EXT. CONJ.	NO. OF CASES	DELIV. SPONTANEOUSLY	NO. TREATED	FORCEPS	V. & E.	CES.	CRAN.	IND.	RESULTS	
									MATER.	FETAL.
20	1449	1312	137	87	30	10	6	4	1	32
19.5-18.5	437	388	49	35	8	4	0	2	0	9
18 -17	112	82	30	17	2	2	0	9	0	14
16.5	2	2	0							
TRUE CONJ.										
10.5	1881	1881	0							
10 - 9	99	85	14	6	6	0	0	2	0	5
8.5- 7.5	20	12	8	2	0	6	0	0	0	0

external conjugate and no corresponding diminution in the true conjugate.

The attempt to engage the head while the examining finger is still in the vagina will give very valuable information as to the passage of the head through the pelvis, and in the Montreal Maternity we have confirmed over and over again the great value of this maneuver, when practiced under an anesthetic—a method which should never be neglected in borderline cases when labor by *vias naturales* is to be permitted.

After we have completed the detailed study of the pelvis, the problem is still before us as to the delivery of the individual, and before formulating rules for this procedure, I would like to review the work that has been done in the Montreal Maternity.

A study of Chart II shows that, of the 18,670 cases that were delivered, 1,935 showed a contraction of the pelvis.

CHART II

THE MONTREAL MATERNITY HOSPITAL
1906 - 1923

No. of Patients delivered	18670
" " Pelves measured	13158
" " Pelves showing contraction	1935
" " Patients with contracted pelvis delivered spontaneously	1462
" " Patients requiring operation	473

OPERATIONS

TYPE OF PELVIS		NO. TREATED	FORCEPS	IND.	CES.	CRAN.	IND.	MATERNAL	FETAL
G.C.		173	60	25	40	12	36	2	35
Rac.		182	52	37	53	13	27	4	44
Mas.		106	73	6	14	5	7	2	20
Dis.		12	1	0	10	1	0	0	2
		473	186	68	117	31	70		
Results	Maternal	2	1	5	0	0	8		
	Fetal	31	21	7	31	11		101	

Of these 1,935 cases, 1,462, or 75.5 per cent, delivered themselves spontaneously, leaving 473, or 24.5 per cent, requiring some operative procedure. A further study of these 473 cases shows that 186 were delivered by forceps with two maternal deaths (1 cardiac, 1 sepsis), while 31 infants, or 16.6 per cent, perished during their stay in the hospital. Version and extraction accounted for 68 cases, with one maternal death from hemorrhage, but with the loss of 21 infants, or 30.8 per cent. Cesarean section was performed 117 times for cases of contracted pelvis, with the loss of five mothers (three septic, one cardiac, one sarcoma); seven babies perished. Craniotomy proved an absolutely safe operation for the mother, there being no maternal deaths in our series of 31 cases.

Labor was induced in 70 cases with the very gratifying result that no maternal deaths followed, while the loss of eleven infants (15.6 per cent) is lower than in any other method of vaginal delivery.

A study of the chart in the opposite direction gives the results obtained in all cases of contracted pelvis, which had previously been divided into the four groups, and there is a remarkable similarity between the number of cases, the number requiring operation and the fetal death rate.

A summary of this work shows:

(a) The large percentage of cases that delivered themselves normally.

(b) The high fetal death rate in version and extraction.

(c) The comparative safety of cesarean section, especially if made an elective operation.

(d) That craniotomy should be safe for the mother.

(e) That a timely induction of labor gives results that compare favorably with other methods of delivery.

Based upon these findings it would appear to me that certain definite rules might with advantage be formulated regarding the treatment of the cases with contracted pelves, and by referring to Chart III it will be seen that I have divided them into three groups depending whether the conjugata vera is 7.5 cm. or under, 9 cm. or over, or between 7.5 and 9 cm.

If the conjugata vera measures 7.5 cm. or less, and the patient is seen during her pregnancy, or early in labor, no one will question that under appropriate conditions, a cesarean section gives the best chance for mother and child.

If, however, the patient is seen in labor, the membranes ruptured, and attempts at delivery have been made, the problem is not so simple and requires the exercise of courageous judgment.

Realizing the great advance that has been made in utilizing the

CHART III

7.5 cm. or less	Seen during pregnancy—cesarean section. " " labor, non-infected, cesarean section " " " infected, attempt at forceps and craniotomy. " " " fetus dead—craniotomy. Less than 5 cm. always do cesarean section, or Porro cesarean if infected.
9 cm. to 10 cm.	Test of labor.
7.5 cm. to 9 cm.	Test of labor. " " " plus Walcher position. " " " " " " plus forceps. " " " " " " " " plus craniotomy. Cesarean Section { Elective / After test of labor without examination. Test of labor and pubiotomy and forceps. Version and Extraction. Induction of labor after careful repeated examinations.

low cervical cesarean section, but refusing to believe that it is a panacea, I have formulated for my guidance the following rules:

(a) If instrumental delivery has been attempted, a craniotomy is advised, partly on account of the danger of infection, partly fearing facial or intracranial injury of the fetus.

(b) If the patient is frankly infected, as shown by foul-smelling discharge, etc., a fetal destructive operation is urged.

(c) When the patient is seen in labor with amniotic fluid draining for a period of fourteen hours; with a history of three vaginal examinations made through a field that shows no evidence of surgical cleanliness, my advice is a craniotomy.

(d) In all other cases I am willing to advise some form of cesarean section, perhaps a Porro if previous children are living, perhaps a low cervical cesarean following the technic as advised in the excellent monographs of some European and American gynecologists.

With a true conjugate over 9 cm., better results will be obtained by noninterference, or at least by giving the patient an opportunity to try to deliver herself. I find, however, that there is a great divergence of opinion as to what constitutes a test of labor in these cases. I have always kept in mind the definition laid down by the late Dr. J. C. Cameron of McGill University, which was as follows, "With the cervix fully dilated and membranes ruptured, with recurring pains every four or five minutes for a period of two hours, only then has there been a test of labor." How often a diagnosis of serious dystocia is made long before these requirements have been fulfilled. The employment of the Walcher position to assist the test of labor we have found of the greatest benefit, and frequently one sees the fetal head begin to descend through the brim following a tilting of

the patient's pelvis caused by the nurse's elevating the patient's buttocks for the use of the bed pan.

Cesarean section will always hold a prominent place in the solution of these cases, and if made an elective operation, or after a test of labor without pelvic examination, it is a safe and sane operation.

In Montreal pubiotomy has not been practiced to any great extent, but in combination with forceps, or as a prophylactic measure in breech extraction, it has, in a large obstetrical center, some merit.

A timely induction of labor will undoubtedly always hold its place in the treatment of this class of cases, not as a measure to bring puny undersized infants into the world, but as an operation to lessen the maternal morbidity and mortality.

In closing, may I call attention to the fact that during the great war those operating at the casualty clearing stations were aided very materially by suggestions that were communicated to them by the consultants of the various armies as to the methods that were giving the best results in certain surgical conditions? These suggestions were changed from time to time, and gave valuable aid to the proper surgical treatment of our soldiers.

The American College of Surgeons in their hospital standardization scheme are beginning to lay down the equipment needed, and indicating the line of treatment to be followed in certain conditions, and it seems to me that this is an opportune time to set our obstetrical house in order, and I am sure that a definite advance could be made by adopting for our students a simpler classification of the pelvis; if men already in practice could be taught the great benefits to be derived from a prenatal examination, and from a careful measurement of the pelvis.

A still further advance could be made if some unanimity of opinion could be arrived at regarding the proper treatment of mildly infected cases, suffering with pelvic dystocia and requiring delivery, and if this concerted opinion could be sent to the various obstetrical centers of America.

118 Crescent Street.

(*For discussion see page* 787.)

THE CAUSE AND PREVENTION OF POSTOPERATIVE GAS PAINS*

By Chas. D. O'Keefe, A.B., M.D., St. Louis, Mo.
(From the Gynecological Service of Barnes Hospital)

THIS is an old subject upon which much has been written; in fact so many routines have been proposed that one is only in a quandary after reading the extensive literature. All writers have agreed upon the prevalence of gas pains following abdominal operations, and the discomfort to which the patients are subjected. However, where some were convinced that the preoperative preparation was of all importance, others have laid great stress upon the operative and postoperative care. The lack of harmony in the treatment from the preparation through the postoperative course is indeed striking.

A study of this problem was begun in 1919 and continued through the following three years of clinical observation on the cases tabulated in this paper. Our routine at the beginning of this study was as follows: Purgation with castor oil at 4 P.M. the day before, with a soapsuds enema on the morning of the operation. Breakfast was omitted on the day of the operation, with a light lunch and dinner the preceding day. The preoperative sedative consisted of morphia and atropine. For abdominal cases the postoperative care was Murphy drip proctoclysis with glucose 3 per cent and soda bicarbonate 2 per cent, 200 c.c. of each, every four hours during the first day, and every eight hours the second day. Liquids by mouth were given after nausea had ceased, which usually meant quite a delay because of the persistent nausea and vomiting, which in turn often resulted in a continuation of the proctoclysis beyond the forty-eight hour period.

Under the above routine gas pains were indeed prevalent and their treatment was almost a daily problem. This frequency led us to believe that there was something radically wrong in our pre- or postoperative care, as all of the operations were done by a staff using, as nearly as possible, the same technic.

Our first step was to discontinue castor oil in the preparation and substitute a soapsuds enema. Later postoperative rectal injections were discontinued, followed by various series receiving saline as Murphy drip proctoclysis, saline as a single retained enema, glucose and soda bicarbonate as a retained enema and saline as a retained enema, immediately after the operation and repeated twelve and twenty-four hours later.

*Read before the St. Louis Gynecological Society, April 12, 1924.

The following charts show the number of abdominal cases studied and the percentage of gas pains in each series. Gas pains are distinguished by the presence of repeated vomiting in the postether stage, accompanied by abdominal distress and distention.

TABLE I

CASES RECEIVING GLUCOSE 3 PER CENT AND SODA BICARBONATE 2 PER CENT

TREATMENT	NO. OF CASES	MORPHIA-HYOSCIN IN PREPARATION	LAVAGED	AVERAGE AMT. ETHER IN OZ.	GAS PAINS NO. OF CASES	GAS PAINS PER CENT
Glucose and soda bicarb. by Murphy drip	18	2	7	7.3 (9 cases)	6	33.3
Glucose and soda bicarb. as single retained enema	20	15	16	7.5 (14 cases)	6	30.
Glucose and soda bicarb. by Murphy drip with castor oil in preparation	24	0	0	6.5 (18 cases)	15	62.5
TOTALS	62	17	23	7.01	27	43.8

Table I shows a total of 43.8 per cent gas pains for glucose per rectum. When castor oil was given in the preparation the percentage increased to 62.5 per cent. The Murphy drip proctoclysis resulted in a higher percentage of gas pains than did the single amount of glucose and bicarbonate as a retained enema.

TABLE II

CASES RECEIVING NOTHING PER RECTUM, WITH CASTOR OIL OMITTED IN THE PREPARATION

TREATMENT	NO. OF CASES	MORPHIA-HYOSCIN	LAVAGED	AVERAGE AMT. ETHER IN OZ.	GAS PAINS NUMBER	GAS PAINS PER CENT
Castor oil omitted Nothing per rectum	23	0	0	6.9	6	25.6

Twenty-five and six-tenths per cent gas pains resulted. One case had severe bleeding from the cervical stump following a supravaginal hysterectomy and undoubtedly would have had gas pains regardless of the pre- or postoperative treatment.

This series resulted in 16.6 per cent gas pains with only 9.6 per cent from repeated enemata. The 33.3 per cent gas pains with the Murphy drip is higher than would be expected, but probably would be less over a greater number of cases.

An attempt was made to run a series of rectal feedings with glucose and soda bicarbonate by the Murphy drip method following

TABLE III

CASES RECEIVING NORMAL SALINE PER RECTUM, WITH THE METHOD USED. NO CASTOR OIL.

TREATMENT	NO. OF CASES	AMOUNT OF ETHER IN OZ.	MORPHIA-HYOSCIN	LAVAGED	GAS PAINS NUMBER	GAS PAINS PER CENT
Saline as Murphy drip	6	11 (2 cases)	1	0	2	33.3
Saline as retained enema (Not repeated)	59	8.5 (48 cases)	19	9	11	18.5
Saline— 750 stat. 300 in 12 hr. 300 in 24 hr.	31	5.6 (26 cases)	31	1	3	9.6
Totals	96	8.6 (76 cases)	51	10	16	16.6

minor vaginal operations. However, the objections of the patients were so forceful that only one case received the feedings over the full forty-eight hour period. This case, a dilatation and curettage, had considerable nausea with some vomiting, but no abdominal distention. The patient complained bitterly because of the presence of the rectal tube and had marked mental unrest. Two interposition operations received Murphy drip proctoclysis, one glucose and soda bicarbonate and the other saline. Both vomited and had considerable pain; however, there was no distention.

Through the courtesy of the Obstetrical Department, the results following cesarean section are given.

TABLE IV

CESAREAN SECTIONS

TREATMENT	METHOD GIVEN	NO. OF CASES	LAVAGED	GAS PAINS NUMBER	GAS PAINS PER CENT
Glucose 3 per cent Soda-bicarb. 2 per cent	Murphy drip	2	0	2	100
Saline	Murphy drip	1	0	0	
	As single enema	3	0	3	100
Nothing per rectum		4	0	2	50
Total		10	0	7	70

The majority of these cases were scheduled and received the usual preoperative enemata without castor oil. Atropine gr. $\frac{1}{150}$ was given, morphia being omitted. The amount of ether was not recorded in enough cases to approximate an average.

The cesarean sections are only mentioned in order to show the prevalence of postoperative gas pains, regardless of the pre- or postoperative treatment. This, no doubt, can be attributed to the intestinal irritation that is set up through the spilling of the uterine contents, the direct trauma to the pelvic and abdominal organs and perhaps

to the relief of abdominal pressure. The high percentage of gas pains with stormy postoperative courses, shows that cesarean section should be held strictly to its indications and not taken so lightly by the surgical enthusiasts.

No attempt has been made to compare the effect of ether, morphia-hyoscin and postanesthetic lavage on gas pains as figured on a percentage basis. However, their importance as contributing factors will be referred to later.

From the study of the cases tabulated it is quite apparent that the preoperative, operative and postoperative care are all important in the end result of every case. A few years ago it was universally customary to starve and purge the patients before operation. Oschner,[1] as late as 1918, strongly recommended purgation 12-24 hours before operation followed by a diet of broth. Harbin[2] stated that a laxative lessens the gaseous contents of the intestinal tract. Shier[3] condemns purgation the night before, but recommends a mild cathartic two days prior to the operation. Moynihan[4] also precedes his operations with cathartics and even goes so far as to give sterilized liquids by mouth. In contrast with these recommendations we find many men strongly opposed to cathartics in any form. Peet[5] advocates only enemata and states that purgation results in psychic and physical unrest, loss of sleep, loss of body and intestinal fluids, hypotonicity of the intestinal walls and a change in the intestinal flora resulting in a preponderance of the fermentation organisms. Alvarez and Taylor[6] have shown a disturbance of the mesenteric circulation with a break in intestinal rhythm following cathartics. In addition, Alvarez[7] has shown that isolated segments of rabbit intestines give weak and irregular contractions in Ringer's solution, following a laxative, while they respond with irregular rhythm following castor oil. He also points out that the intestines empty in 7-9 hours, following which time the colon alone contains waste products and if not spontaneously evacuated can be easily and thoroughly cleansed by an enema on the morning of the operation.

If the small intestine empties itself in nine hours, it is not only useless to purge 24 to 48 hours before the operation, but it is unnecessary to use cathartics at any time in the preoperative preparation. It is likewise wrong to withhold food from the patient except immediately before the operation. At present, it is our custom to omit breakfast for an early morning operation, but a regular diet is allowed the day preceding. A free intake of water is encouraged up until within one hour of the operation.

From the clinical study, gas pains resulted in 62.5 per cent when castor oil preceded the operation and in 33.3 per cent when it was omitted. Murphy drip proctoclysis of glucose and soda bicarbonate

was used in each series and, as will be shown later, accounted for the high percentage of gas pains.

During the operation trauma is the important factor to be considered. Long drawn out operations are closely associated with stormy postoperative courses. This is due to direct trauma, indirect trauma through long exposure, or to ether saturation. Quick, neat work is to be encouraged, but care should never be sacrificed for speed. There are many men who will strive for a fifteen minute appendectomy or needlessly hurry through a cesarean section and yet these same men will take two to four hours to perform other pelvic work in a very leisurely manner.

We have all witnessed operations where the intestines have been carelessly packed and a loop allowed to be compressed against the abdominal wall or even allowed to rest outside the incision. Again we have seen a loop of intestine actually pinched and held for many minutes by a retractor.

Bissell[8] has offered his rubber pads as a means of lessening trauma and claims a 50 per cent reduction of postoperative vomiting through this method, due to a decrease in intestinal irritation. He does not state whether moist or dry gauze was used in his checks. Although his 50 per cent reduction in postoperative vomiting is indeed striking, I cannot concur with his views as to the importance of this one method. His very obvious mistake seems to have been in his postoperative treatment; glucose and soda bicarbonate proctoclysis having been administered only to his checks. The most favorable aspect of the rubber pads seems to be due to their ability to hold back the intestines because of their own body resistance rather than by pressure through packing, as is found with the use of gauze. A nonirritating packing certainly has its advantages. However, the rubber pads, due to their nonabsorbing qualities, allow the pelvis and abdomen to fill up with blood and debris, which eventually have to be cleansed by sponges. H. S. Crossen, chief of our staff, uses a modified rubber apron to pack off the intestines and thinks favorably of the method. No attempt is made in this paper to compare the results of the different methods. However, it must be remembered that the packing back of the abdominal contents in a pelvic operation is an art in itself, although appreciated and cultivated by very few operators.

If a loop of intestine is compressed over a long period of time, either by packing or a retractor, it becomes at least partially paralyzed through impairment of its blood and nerve supply. This portion loses its ability to respond to normal physiologic action, the most important of which is rhythmic peristalsis and gaseous exchange. All peristaltic waves will end or be reversed at this point and normal gases that would ordinarily be taken care of by absorption through the blood or expulsion through the intestinal tract will have their

origin and accumulation at this point. Distention results because of muscular atony due to impaired innervation. No pre- or postoperative treatment can atone for this injury and gas pains are inevitable. It is the duty then of every surgeon, not only to do justice to the existing pathology, but to respect adjacent structures in order to provide a humane postoperative course for his patient.

Next comes the question of postoperative treatment and it is this phase of the work which prompted this study. In all cases where ether is used—and it is still the universal anesthetic—there will be the so-called "ether stage." We have reduced the amount of ether needed by the use of morphia and hyoscin hydrobromide in the preoperative preparations.[9] In addition gastric lavage is done during the closing steps of the operation. This is best done by means of warm saline solution and undoubtedly is of great value in cleansing the mucosa of the stomach of its ether saturation. The first washings are very high in ether content, the odor being quite pronounced.

I cannot agree with the majority of writers as to the importance of ether in the cause of gas pains. It is undoubtedly a contributing cause, but it certainly has a transitory effect. The amount of ether does not increase in proportion to the time of the operation. In other words, the number of anesthesia minutes per ounce of ether increases as the length of the operation increases.[9] This is because of the large amount required to procure surgical anesthesia. The elimination of ether is very fast, and the twenty-four-hour ether stage that is so often mentioned is, in all probability, about twelve to sixteen hours too long. Ronzoni[10] has shown that 100 c.c. of blood from a dog, following three hours and fifteen minutes of deep anesthesia, contained 135 mg. of ether, while only 10 mg. were present in 100 c.c. of blood two and a half hours later. The ether was practically eliminated at the end of one and a half hours, with a very large drop, 135 mg. to 50 mg., in the first fifteen minutes. If the ether is removed from the mucosa of the stomach and from the blood supply of the gastrointestinal tract, physiologic action should return almost immediately, unless retarded by some preoperative or operative trauma.

When the patient returns to her room there are three important things to be considered: Stimulation of the gastrointestinal tract, nourishment and rest. Stimulation may be carried out mechanically or by the use of drugs. There are many advocates of stimulation with drugs, such as quinine muriate, pituitrin, physostigmin, eserin sulphate, digitalis, etc. Some of these are recognized as valuable in the treatment of gas pains, but even here are questioned by a few writers. As for quinine muriate[11] and digitalis[3] the results cannot be questioned, but there seems to be no scientific basis for their use. It must be remembered that for every drug stimulation there is an opposite and usually unequal reaction which by far offsets the pri-

mary stimulation. Mechanical stimulation, therefore, seems to be the method of choice. This is best carried out by small amounts of saline or water introduced into the intestinal tract. Water by mouth should be given as soon as possible, and much earlier than it is usually administered. If ordered after nausea has ceased, it will always be delayed too long. While waiting for consciousness and delayed intake per os, rectal stimulation should be instigated. Water or saline should be given in small amounts at frequent intervals; the exact amount and frequency are open questions. Intermittent stimulation gives the best results. Our best results were obtained by saline immediately following the operation and repeated twelve and twenty-four hours later, when only 9.6 per cent gas pains resulted. I believe that even better results could be obtained by decreasing the interval at least to every six hours during the first thirty-six hours. Murphy drip proctoclysis is mentioned only to be condemned. With this method overstimulation results; overdistention usually takes place and the psychic effect on the patient is 100 per cent demoralizing.

Nutrient rectal feeding has its place in the treatment of certain diseases where the intestinal tract is capable of normal function, but it certainly has no place in postoperative treatment. In the first place the patient, in all probability, does not need nourishment, but if food were needed, the intestinal tract is in no condition to assimilate it. No one would insult the stomach with food at this time, yet the gastrointestinal tract below the stomach is a part of the same mechanism and is equally unable to handle food. If nourishment is imperative, it should be given intravenously for quick stimulation, or subcutaneously, if less urgent, but never by rectum until normal peristaltic waves have been reestablished.

The great majority of men give glucose per rectum with some sort of alkaline substance, in the belief that they are giving nourishment and combating acidosis at the same time. In the average case there is no acidosis impending, but if acidosis exists, it should be treated by intravenous alkaline solution, or given per rectum alone. The effect of the citrate or carbonate when given per rectum with glucose will, in all probability, be lost because of the acids liberated through the action of bacteria on the glucose.

At present the rate and amount of absorption of glucose by different parts of the intestinal tract is not quite clear. There seems to be no question concerning the absorption in the small intestine under normal conditions, but many have questioned the ability of the colon and the rectum to absorb it. Tallerman[12] has decided that there is an absorption per rectum, as determined by a rise in blood sugar. However, his patients were apparently not postoperative, and he used 33⅓ per cent solution, which, if not impracticable, is certainly not used by the average surgeon. Many men question the ability of

the gastrointestinal tract to absorb high percentages of glucose, and feel that it causes a marked irritation. Tallerman claimed no irritation from his 33⅓ per cent.

The most important point in the rectal feeding of carbohydrate is whether the nutritive effect is of enough value to offset the ill effects caused by the formation of gas and acids through the action of the intestinal bacteria on the nutritive media. If some absorption takes place before fermentation begins, the ill effects of the latter will follow and overshadow the beneficial results of the very few calories absorbed. We know that glucose in weak solutions is fermented by B. coli and when the coli are mixed with the intestinal contents glucose will be fermented in very much higher concentration. As the greatest number of bacteria are in the region of the ileocecal valve, it does not seem logical to introduce a gas-forming nutrient into this area. Fermentation will result in by-products such as hydrogen, carbon dioxide, lactic and acetic acid, etc., which will not only be of no value but will actually encourage acidosis and stasis.

The whole gastrointestinal tract at this time is in a state ranging from slight peristaltic waves to areas of complete stasis. Thus, the gas as formed will be forced up through the colon, through the ileocecal valve and follow along the lines of least resistance. At best the return to normal rhythmic peristaltic waves is delayed, the amount of distention and vomiting depending directly upon the trauma that has been established by the preoperative or operative care.

The advantage of saline per rectum over the glucose, as shown by the clinical cases, is certainly impressive. The reduction from 43.8 per cent gas pains to 16.6 per cent, other conditions remaining equal, certainly shows that fermentation must take place.

We do not refrain from giving morphia whenever the patient's discomfort warrants a sedative. Undoubtedly morphia retards peristalsis, but pain, fear and worry have a much greater effect toward stasis than the effects of morphia or codein. I believe that pain, fear, nervousness, etc., play a greater part in the cause of gas pains than does the effect of ether anesthesia. For this reason the nervous patient should have both pre- and postoperative sedatives. Taylor, Terry and Alvarez[13] believe that the postoperative purge should also be discontinued. In this I agree; however, I do feel that simple enemata have a stimulating effect on peristalsis and that enemata or mild cathartics should always be given when the food intake has been sufficient to warrant a movement. Routine purgation on a given day will create more harm than good in a large number of cases. It is useless to purge an empty intestinal tract or one that contains waste products only in the colon or rectum. The ill effects of purgatives always stand out and are not in keeping with the quiet, uneventful postoperative course that is hoped for by all concerned.

In summarizing, the following conclusions are offered:

1. That regular diet may be given to within twelve hours of the operation.

2. That purgation is not only unnecessary but harmful.

3. That avoidable trauma to the abdominal contents during operation is too often the cause of postoperative gas pains.

4. That the ether effect may be alleviated by the preoperative use of morphia and hyoscin hydrobromide and the postanesthetic gastric lavage.

5. That peristaltic action should be stimulated immediately following operation; intermittent injections of saline or water being the method of choice. Drugs should be discouraged.

6. That postoperative nutrient rectal feeding predisposes to gas pains.

7. That the disadvantages of the Murphy drip proctoclysis outstrip the advantages.

8. That morphia should not be denied whenever the patient's discomfort demands it.

9. That pain, restlessness, sleeplessness and fear play an important part in the stasis of the gastrointestinal tract.

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WALL BUILDING.

THE CAUSATION AND TREATMENT OF RUPTURE OF THE UTERUS*

By Barton Cooke Hirst, M.D., Philadelphia, Pa.

THIS communication is a record of clinical experience in rupture of the uterus rather than a literary or statistical research. I find it necessary in reviewing my personal experience with the causes of rupture of the uterus, to divide the accident into ten separate classes, presenting one or two examples under each head.

1. Rupture of the uterus due to maternal obstruction: Contracted pelvis is usually thought to be the commonest cause, but in Koblanck's analysis of eighty cases, fetal obstruction was the cause more than twice as often as a contracted pelvis.

We have had a recent example in our out-patient service of a moderately contracted pelvis in a woman in labor for the fourth time, with a child that proved larger than the other three. She had been delivered before without special difficulty. After some eighteen hours of labor her pains suddenly ceased and there was a slight bloody discharge from the vagina with symptoms of shock. Unfortunately the practitioner in attendance apparently did not recognize the true nature of the case and there was some delay in procuring a consultant. Upon his arrival the case was transported to the University Hospital in the ambulance but there was a collision about a mile from the hospital with another motor car with the result that the woman was thrown onto the street. She was then taken to my hospital service in the lower part of the city and there operated on immediately. She died three days later of pneumonia apparently from exposure, but the postmortem examination showed that the peritoneum was perfectly healthy and that the uterine walls which were sutured instead of eradicating the uterus, had completely healed.

2. Fetal obstruction: Hydrocephalus, is the most important, as malposition and overgrowth are not so likely to be overlooked.

In the out-patient service we had a breech presentation which was delivered as far as the shoulder, but the practitioner then experiencing difficulty, a consultant was summoned who thought that enough strength had not been applied to the shoulders. Consequently he pulled much more vigorously with the result of rupturing the uterus its entire length and also rupturing a hydrocephalic head. I operated on the woman as soon as she arrived in the hospital, did a difficult hysterectomy under the most unfavorable conditions and fortunately she recovered.

3. Spontaneous: Rupture with or without a scar from a previous operation.

I have seen two cases of spontaneous rupture of the uterus in addition to those that are now unfortunately quite common following cesarean section. I regret to say that I have had one of these following my own operation, the only one as far as I know.

*Read at a meeting of the Obstetrical Society of Philadelphia, February 14, 1924.

The two cases of spontaneous rupture occurred in very fat women who had become suddenly obese just before their last pregnancy; there was no obstruction whatever in either case but the uterus ruptured extensively and the child was expelled into the peritoneal cavity.

One case was a transverse rupture of the fundus from tube to tube. I only saw the woman a month after her delivery and operated for what I supposed to be a pelvic abscess but found the uterus with a complete rupture through the fundus into the peritoneal cavity, walled off by peritoneal and intestinal adhesions. A hysterectomy fortunately, was satisfactory in this case.

4. Perforation from localized necrosis.

There was an interesting example in my service in the Philadelphia Hospital. A woman was delivered spontaneously without any suspicion of injury to her uterus, but when she got out of bed she suddenly discharged considerable quantities of clear fluid from the vagina. We naturally thought of an injury to the bladder but a careful examination showed that there was a round hole in the uterine wall corresponding with the promontory of the sacrum during labor and communicating with a limited portion of the peritoneal cavity in which there had been a secretion of ascitic fluid that was discharged through the orifice in the uterus from time to time with the patient in the erect posture.

5. Rupture by internal manipulation.

Unfortunately under this head a number of examples might be given, but two will suffice. In one, a physician attempting to control uterine hemorrhage at the fifth month ruptured the vaginal vault. He then succeeded in inserting his hand in the uterus whereupon he ruptured the fundus. When I saw the patient shortly afterward, I found the original operator with his hand and arm up to the elbow in the woman's abdominal cavity which he had opened with the instruments in his pocket case. He was holding on to the ruptured uterus with the idea he said, of controlling the hemorrhage.

In another case brought into the University Hospital, the uterus was completely ruptured, two pieces of intestine detached from the mesentery, were hanging out of the vulva and both the baby's arms had been pulled off in an attempt to do version, the arms, apparently, having been mistaken for the legs.

It is a commentary on the present fad for an immoderate resort to version that out of Koblank's eighty cases of rupture, twenty-nine or thirty-six per cent, were due to version.

6. Perforation by instruments through the vagina.

Under this head, too, numerous examples could be presented but I have chosen five out of a larger number.

In one, the uterus was perforated by an instrument inserted in the third month with the idea of emptying it. The small intestine was caught and was pulled on until the whole length of the small bowel was pulled out and then pulled off. In another case the uterus had been perforated by an instrument; the ileum, was caught just short of where it enters the caput coli, torn across, and then pulled back into the uterine cavity where it was firmly fixed, so that all the contents of the intestine except the large bowel oozed out of the external os uteri. I operated on this woman some twelve days after the original injury doing an intestinal anastomosis and a hysterectomy, but the woman was so toxic that she did not survive the operation.

In one of my hospital services an intern endeavoring to estimate the duration

of pregnancy in a partly completed abortion, perforated the uterus with a sound and I found omentum in the uterine cavity.

In another case in another hospital service, the intern perforated the uterus in an attempt to clean out an incomplete abortion and then gave the woman an intrauterine douche of bichloride of mercury. That was years ago when this antiseptic was generally employed, but instead of delivering the fluid into the uterine cavity, he passed his two-way catheter into the abdominal cavity and we recovered something like a quart of bichloride solution from the peritoneal cavity in the postmortem examination. In another case, in which a doctor had induced abortion on his wife, and then called in another physician to complete it, there was a rupture of the uterus by an instrument, with death shortly afterward, from peritonitis. The woman, when I saw her, was beyond aid.

In another case a patient had used a long handled buttonhook to induce abortion on herself. She perforated the uterus, twisted the buttonhook about in the peritoneal cavity, caught a loop of intestine in the hook and tore a hole in it. I was obliged to do an intestinal anastomosis and a hysterectomy, fortunately with a successful result.

7. Perforation of the uterus through the abdominal wall.

Under this head I have seen two rather remarkable examples.

In one, in the Maternity Hospital of Philadelphia, a young girl illegitimately pregnant, determined to destroy her fetus, so she passed a long hatpin into her abdomen at the umbilicus transfixing the fetus and accomplishing the result she desired. The fetus was born dead shortly afterward, but the woman suffered no ill consequence whatever, except for a few drops of pus which oozed out of the navel for two or three days.

In another case a girl attempted to commit suicide at the fifth month of pregnancy by shooting herself through the abdomen. She miscalculated the height of the fundus uteri, however, and placed the muzzle of the revolver just above the umbilicus. The bullet entered this point and emerged from her back. She made a perfectly spontaneous recovery and was delivered under my observation at term. This does not come under the head of a perforation of the uterus but was an attempt I think not only to commit suicide but to destroy the evidences of the girl's condition. At least that was the thought, I believe, in her mind.

8. Rupture of lower uterine segment in placenta previa treated by version.

There is a possibility of ruptured uterus in performing version for placenta previa no matter how carefully the operation may be performed. I once had an experience of this sort before a class of students, in which I treated a case of placenta previa in this manner; pointing out the danger of rapid extraction of the child; mentioning the possibility of rupture of the lower uterine segment on account of the alteration in its texture; waiting a considerable length of time after the performance of version before proceeding to extraction, at least an hour and three-quarters or two hours and then completing the operation with the utmost gentleness and care. I was chagrined to find a rupture of the lower uterine segment in which I could put my fist. The woman recovered with gauze pack and drainage.

9. Perforation of the vaginal vault.

I once saw an interesting example of perforation of the vaginal vault by forceps. The physician had attempted to apply forceps before any dilatation of the external os whatever, but with complete effacement of the cervix and great

distention of the lower uterine segment. Mistaking this portion of the uterus for the child's head, the blades of the forceps, which were inserted with a good deal of force had perforated the vaginal vault, then when traction was made, naturally the uterine wall itself was lacerated by the traction exerted on the lower uterine segment. When I saw this woman in consultation she was moribund and nothing could be done for her.

10. Partial rupture of peritoneal coat and superficial myometrium by imposition of weight on the abdomen.

Under this head I have seen a remarkable instance of rupture of the perimetrium and superficial portion of the uterine wall, without complete involvement of the myometrium and without entrance into the uterine cavity, but with death from profuse hemorrhage. This accident was due to coitus in the last month of pregnancy; the husband was a man of large stature and unusual weight; at least two hundred and fifty pounds. Curiously enough he had lost his first wife with the same symptoms at the same date of pregnancy and obviously I think, from the same cause.

The treatment of ruptured uterus must be adapted to the individual case. There is a choice of inactive treatment; irrigation and gauze drainage; gauze pack alone; and abdominal section, often with the necessity of intestinal anastomosis or closure of intestinal puncture.

I once had a remarkable case of complete recovery of ruptured uterus without any active treatment whatever. The woman refused the induction of labor which I first suggested; she then fell in labor which was obstructed by a rachitic pelvis. She refused a cesarean section which I urged on her; she stipulated that she might make an effort to deliver herself during the night and then if she did not succeed she would consent to the operation, but just before I arrived in the hospital the following morning, by one stupendous effort, she ruptured her uterus, expelled the baby at the same time, dead with a spoon-shaped depression in its skull. I then insisted on operation for the ruptured uterus but she flatly refused and curiously enough made a complete and satisfactory recovery without any treatment at all, having refused the correct advice I had given her on three separate occasions. Like everyone with much experience in obstetrics I have treated ruptured uterus by various plans: irrigation and gauze drainage through the vagina, with the rupture low down and posteriorly; hysterectomy a number of times; intestinal anastomosis in several of the cases; sewing the rent and peritonealizing it without attempting to remove the uterus and in some instances splinting the wound, if it was anterior, as Leopold suggested by pressing the uterus forward on itself by means of an extensive intra-pelvic tampon inserted from above, behind the uterus. There is no routine treatment for this condition, but the operator must use judgment and discretion and be guided by experience.

It is impossible for me to present a statistical account of my own

work of more than thirty years in a number of hospitals and in different localities. The best statistical study I know of which shows the results of various treatments, is that of Schultz, in which it appears that out of 323 cases of rupture of the uterus, the mortality of inactive treatment was 78.8 per cent; of irrigation and drainage 64 per cent and of the operative treatment 55.3 per cent.

1821 Spruce Street. (*For discussion see page* 804.)

A RARE CONGENITAL ANOMALY

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THE association of hydrocephalus, spina bifida, and talipes in the same fetus is a rare finding as evidenced by a careful search of literature. Similar cases may have been seen but apparently not reported. There were two other cases found in the literature, comparable to the one which the writer wishes to report. Hydrocephalus alone is not so uncommon, about 1 in 1500 cases and spina bifida about 1 in 1000 cases.

ETIOLOGY

Edgar[1] says that "during the period of embryonal life, which is computed by various authors to be from 6 to 12 weeks, what is known as organogenesis occurs. During the remainder of intrauterine existence there is a little more than an increase in size, just as in extrauterine life. It seems almost natural to suppose that disease in the embryo must be manifested rather by arrested development or perversion of organs than by ordinary pathologic alterations. A slight malformation of an embryonal organ must increase in size with the growth of the latter; in no other way could the occurrence of extensive malformations be explained. On the other hand, a few true deformities may arise during the fetal period because organogenesis, while nearly completed in the earlier weeks of gestation, goes on to a certain extent throughout intrauterine life and through many years of individual existence."

Regarding the time sequence of the structures which participate in the defect, normally the entire neural tube is closed at the end of the third week, and is the full length of the embryo. Also the vertebral neural arches from the first cervical to the third or fourth sacral are closed at the eleventh week, the arches below the fourth sacral are normally rudimentary. The defect, whether it be a failure of closure of the medullary groove or an adherence of the meningeal layers to the skin, cannot occur after the vertebral arches are closed and at this period of growth and indeed for a short time thereafter

(third month) the vertebral column and spinal cord are increasing, *pari passu,* so that each cord segment lies in line with the corresponding vertebral segment. However, should defect occur, the general development of the rest of the embryo may go on unaltered except by mere mechanical hindrance at the point of defect.[2]

Sharpe[3] states that "the majority, if not all cases of spina bifida are caused by pressure of an excessive secretion of spinal fluid." The excessive secretion in hydrocephalus is well known.

Barnet[4] points out times when accidents are most likely to occur in the osseous development of the spine. He says that "from the time that the differentiation of scleromatous cells begins, any pathologic factor may operate to produce any degree of defect."

The normal formation of the neural arch involving the medullary tube takes place by the growing, lateroposteriorly, of processes of scleromatous tissue from the primitive vertebrae. These processes, known as the "primitive bows," are destined to meet dorsally to form a closed membranous canal which is chondrified at the fourth month. In a case of lumbar spina bifida, where there is an absolute inhibition of the growth of the vertebral bows, the neuropathology resulting from the gross osseous defect of the neural canal makes talipes a sequence to spina bifida, as the feet continue to maintain their intrauterine position.

We are still deeply ignorant of the manner in which monstrosities are produced. Studies of very early embryos which have perished from intrinsic causes or from affections of the membranes throw hardly any light on the genesis of these monsters.

Bailey and Miller[5] say that "the earlier view that the deformity was due to an accumulation of fluid within the spinal canal in spina bifida is now usually considered untenable. At the present time it is generally agreed that spina bifida is closely related to defective closure of the neural tube although the exact nature of this relation is not known."

Mall[6] says that "all theories of the origin of monsters are concerned with the question whether the conditions that produce a monster are germinal and hereditary or are external influences acting upon a normal germ."

The theory which seems to be in favor now is the physicochemical. It has gained ground because certain definite malformations have been obtained by subjecting the living egg or young embryo to unusual conditions, either physical or chemical. The results obtained, the strange creatures which develop after such interference, are not infrequently comparable with malformations and monsters found among the higher animals and strongly suggest that malformations among the higher forms are the results of similar interference with the normal course of development of the egg.

Experiments with lower forms of life have been made and a great variety of monsters produced; e.g., by shaking sea-urchin eggs when in 2-cell stage so that the blastomeres are separated. Each one can be made to grow into a whole embryo. Depending upon the degree of separation, the two embryos will be separate or more or less united, forming a double monster. Frogs' eggs have been made to produce double monsters by keeping them turned upside down after the "morula stage"; the same result has also been produced by loosely tying a ligature in the furrow between the two primary blastomeres. A most curious result has been obtained by splitting the limb bud of a growing tadpole one or more times. Two or even a cluster of limbs may develop where only one does normally.

While these experiments do not prove that there are no other modes of origin for malformations possible, they indicate the importance of external influences on development and afford tangible evidence in the study of monsters. It is possible to produce typical spina bifida in frog embryos by putting them, during the early stages of development, into a 0.6 per cent solution of sodium chloride. If the eggs of Axolotl are treated with a 0.7 per cent sol. of sodium chloride, all the embryos have spina bifida (Hertwig). If the eggs of Fundulus are placed in a solution of magnesium chloride, 50 per cent of them produce embryos with cyclopia (Stockard). These experiments, from the enormous number which have been tried, lead to the conclusion that at least some malformations in single individuals are due to external influences and not to germinal defects.[5]

While we do not believe in prenatal influence or that so-called birthmarks are the result of some unusual sight, craving or emotion during pregnancy, it might be possible that we have not gone far enough in our studies of the chemistry of the body secretions and that some of the deformities which we see are but reproductions of the experiments done on the lower vertebrates, where the normal menstruum surrounding the egg is but slightly altered. We do not know precisely the effect upon the chemistry of the secretions of the body brought about by the emotions, such as anger, fear, fright, extreme joy or sorrow. Is it not possible that during the early weeks, when the human ovum is buried beneath the decidual layer and bathed by the fluids of the body, slight alterations in the chemical or normal balance of these fluids may retard organogenesis on the one hand or accelerate it on the other?

The following cases have been previously reported:

Hydrocephalus, Spina bifida, and Double Talipes Calcaneous in the same infant (Conklin[7]). Case history is negative. Parents both in good health. Fetus (male) stillborn, size of full term child; occipitofrontal circumference 52 cm., occipitomental, 46 cm., vertex-coccygeal length, 32 cm. Over lower lumbar region was typical swelling of spina bifida and the feet were in position of talipes calcaneous.

MENINGO-MYELOCELE.
TAL. EQUINO-VARUS
TAL. CALCANEUS.

Fig. 1.

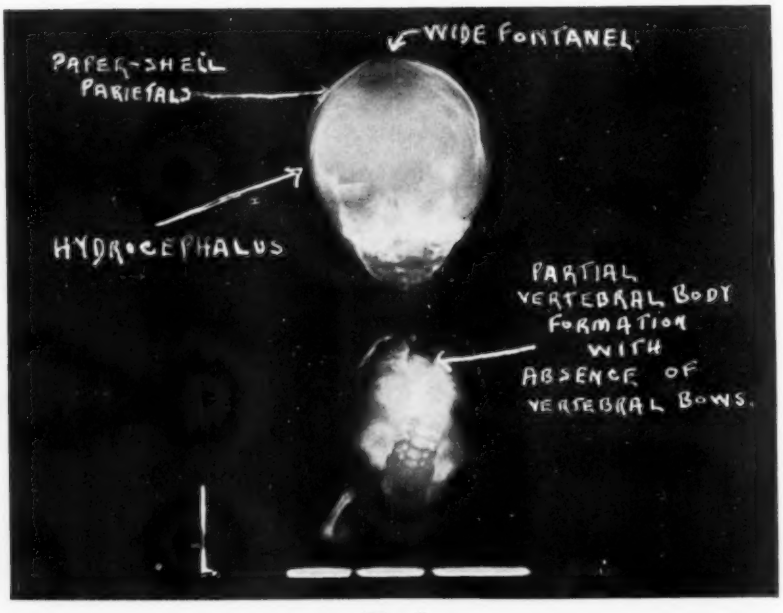
WIDE FONTANEL
PAPER-SHELL PARIETALS
HYDROCEPHALUS
PARTIAL VERTEBRAL BODY FORMATION WITH ABSENCE OF VERTEBRAL BOWS.

Fig. 2.

Hydrocephalus, Spina bifida, and Double Talipes Equino-varus in the same infant. (Davidson[8]). In this case an attempt was made to establish a causal connection between the mother falling downstairs during the fourth month of pregnancy and the occurrence of the deformities. The head had to be perforated in order to deliver it.

The writer's case:—Mrs. O., twenty-three years old, in good health. Husband also in good health. Wassermann negative. They have one child 20 months old which is perfectly formed. No history of injury during pregnancy or of maternal impressions. She has a simple flat pelvis with a true conjugate of 7.5 cm. Patient went into spontaneous labor two weeks before due, probably on account of the marked hydramnios present. The presentation changed from vertex to breech during the week before and could not be corrected. Fetal heart was strong all through labor, rate 140, and the membranes remained intact till complete dilatation of the cervix. The foot, in equinovarus, was hard to distinguish from a hand. In the course of the breech extraction, the spina bifida presented, followed by the enlarged head, which was delivered without puncture. Fetus was alive and of good color for about five minutes, when it expired. Hydramnios was estimated at between 3 and 4 quarts. Measurements of the fetal head were: Occipitofrontal circumference 42 cm., occipitomental 47 cm., sub-occipito-bregmatic 39 cm. or an increase of 7, 9, and 11 cm. in the circumferences of the head over the normal averages. Vertex-coccygeal length was normal.

Fourteen months later patient gave birth to a perfectly formed female infant.

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27 Eagle St.

ACUTE HYDRAMNIOS AND HOMOLOGOUS TRIPLETS

By Lawrence M. Randall, M.D.

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ACUTE hydramnios is a pathologic condition rarely encountered, and as a complication of homologous triplets, it must of necessity be very infrequent. In approximately one of 150 pregnancies, there will be observed a definite excessive quantity of amniotic fluid, which does not, as a rule, develop rapidly. Burstal, in 1910, recorded 13,967 pregnancies with 133 instances of hydramnios, in which no mention of the acute form was made and no triplets were encountered. Chambrelent, in 1914, asserted that acute hydramnios is relatively rare, and he found only fifty cases recorded in the French literature, in none of which were triplets mentioned.

The cause of excessive amounts of amniotic fluid is not definitely known; indeed the origin liquor amnii in normal patients is not definitely known. The majority of instances of hydramnios are held to be associated with some fetal anomaly but whether these anomalies are cause or effect, or whether anomalies and excessive amounts of liquor proceed from some other unknown factor, has never been definitely determined. The condition is usually associated with multiple pregnancy, particular attention being called to the frequency of its occurrence with uniovular twins. The incidence also seems to increase with the parity of the patient.

Plauchu believes that there are two forms of acute hydramnios, the one which appears during the first months of gestation, in which group the patient reported here evidently belongs, and the one which develops in the later months of normal gestation, or supervenes on hitherto chronic hydramnios. Plauchu reported a case of acute hydramnios of the first type, and said that this type of hydramnios appears early and is marked, that it indicates twin pregnancy, and that abortion occurs at an early date. In eleven cases cited by him, two patients aborted at four months, seven at five months, and two at six months.

Clinically, the diagnosis should usually be established easily. The treatment is definite and the prognosis good for the mother, although death of the mother has been reported, due to postpartum hemorrhage incident to the extreme stretching of the uterus with consequent atony of the uterine musculature, ruptured uterus, and sepsis. For the infant the prognosis is almost uniformly bad because of anomalies often associated with hydramnios and because the pregnancy so often terminates prematurely. Krahula in 1920 collected all cases of hydram-

nios from the Bonn Clinic and cases reported in *Zentralblatt für Gynäkologie* between 1877 and 1910, and found that 103 of 291 infants were born dead; only eleven (3.78 per cent) lived, and only three (1.3 per cent) were healthy. The maternal mortality was not mentioned. Floris collected 224 cases of hydramnios which occurred in Vienna between 1910 and 1921; there were 32 twins, no triplets, 49 stillborn infants, 24 who died soon after delivery, 183 born alive, 95 premature infants, 30 monstrosities, and 5 syphilitic infants, 3 of whom lived. The case observed in the Mayo Clinic is rather unusual in that it is an instance of acute hydramnios, complicating a uniovular triplet pregnancy.

REPORT OF CASE

The patient, aged twenty-three years, para 2, was first seen February 22, 1924. There had been no multiple pregnancies among the other members of her family. When the patient was twelve years old she fell from a loft, striking her back on a wheel. In the last two years she has had some pain in the back, and recently had seemed to be "stoop shouldered." The first pregnancy terminated spontaneously at term, eighteen months before examination, after an uneventful gestation. The last menstrual period was August 28, 1923. The first four months she experienced considerable nausea and vomiting, although not severe. Urination was frequent, but there was no dysuria. The bowel movements had been regular. The patient had noted a marked and rather rapid increase in the size of the abdomen since the first month. This increase was great enough to make one suspect a possible mole formation. She had felt tired and weak, and had lost about 5 pounds in weight. Her appetite had been fair.

At examination she looked pale, rather anxious and tired. When she lay on her back on the examining table, breathing was difficult and she felt faint. Her teeth were in poor condition. Examination of the heart was negative, and examination of the lungs was negative, aside from a few râles in the bases posteriorly, which disappeared on deep inspiration. There was a moderate kyphosis of the spine in the region of the eighth and tenth dorsal vertebrae, and some tenderness on pressure. When the patient was prone, the systolic blood pressure was 88, and the diastolic 42; when sitting, the systolic blood pressure was 108, and the diastolic 72. The abdomen was the size of an eight months' pregnancy, although according to the menstrual history it should have been but six. The uterus extended nearly to the ensiform; it was rather tender and tense. The fetal parts could not be mapped out, but a hard ballotable object was made out in the left upper quadrant together with a distinct fluid wave. Fetal heart tones could be heard just to the left, and above the umbilicus, but were not distinguishable elsewhere, although carefully sought for. The pelvis was ample in size. There was slight leucorrhea, white, with no odor. There was no evidence of venereal disease. The perineum was moderately relaxed. The cervix was lacerated on both the right and left. The os admitted a finger, and the cervix was fairly well effaced. A bag of waters could be felt in the os but was not tense. Through this could be felt a soft presenting part, but the size could not be determined accurately. The hemoglobin was 60 per cent by the Dare method; the erythrocytes numbered 3,480,000 and the leucocytes 6,200. The urine had a specific gravity of 1,011, an acid reaction, albumin 1, but no casts. X-ray examination of the spine revealed some destruction of the ninth and tenth dorsal

vertebrae, but whether this was a destructive osteitis or a tuberculous process was not definitely determined. The blood Wassermann reaction was negative.

The patient was kept under observation, and March 2, ten days later, we were called to see her because of pains which she thought were labor pains. The patient was dyspneic, propped up in bed, complaining of pain originating in the lower part of the back and radiating to the front, which occurred about every five minutes. The uterus, however, did not seem to contract appreciably with these periodic pains. The most striking observation was the marked distention of the abdomen above the umbilicus. The uterus extended to the ensiform and was very tense. No fetal parts or heart tones could be made out. Through the rectum, the tension in the lower uterine segment did not seem to correspond to the feel of the fundus. The cervix was well effaced and the os admitted a finger.

The patient was sent to the hospital. Sedatives eliminated the periodic pain, but the distress from the extreme distention of the abdomen continued unabated. Her pulse rate was 110, temperature normal, and respiration 25. For forty-eight hours, she was carried along with sedatives but at the end of that time, because of exhaustion, poor general condition and no relief from pain, she was taken to the birth room with the idea of rupturing the membranes and leaving the course to Nature. The os at this time easily admitted two fingers, and a bag of waters was felt which did not seem to be under great tension. Rupture of this yielded about 300 c.c. of clear liquid and a small foot presented. An easy manual stretching of the cervix was accomplished, and a male infant, 30 cm. long weighing 650 gm., was delivered. On introducing the hand again, another bag of waters was felt which also was not under great tension. This was ruptured and again about 300 c.c. of clear liquid escaped. Again a foot presented and delivery revealed a male infant, 31 cm. long, and weighing 676 gm. Even with the delivery of these two infants the size of the abdomen was but little reduced. The hand now encountered in the uterus a very tense bag of waters in which a small fetus was ballotable. Rupture of this sac yielded about 5,500 c.c. of fluid, but much more escaped the container, and a third male child, 32.5 cm. long, weighing 686 gm., was delivered.

After puncturing the sac, the hand was kept in the vagina and fluid permitted to escape slowly, counterpressure being maintained on the abdomen. In spite of the slow release of fluid, the pulse rate rose to 144, was weak and thready, and the patient went into shock. The head of the table was lowered, and a hypodermic injection of digitalis and external heat revived her in a few minutes.

Following the delivery of the last infant, the uterus did not contract, but remained soft and flabby with only moderate bleeding. Stimulation by external massage, and 1 c.c. of pituitrin into the thigh, assisted the contraction and retraction, and the placenta was expressed from the vagina in fifteen minutes. Because of slow oozing from the uterus, and no cervical laceration being found, the uterus was packed with wide iodiform gauze.

The total fluid caught measured 6,400 c.c.; the combined weight of the infants was 2,021 gm., and the placenta weighed 1,200 gm., making a total weight of 9,621 gm. (21.12 pounds).

The placenta was single with three cords, three amnions and one chorion, attached to the posterior wall of the body and fundus. In the large upper sac which accommodated the hydramnios, the insertion of the cord was marginal but not velamentous, the vessels not leaving the cord until the placenta was reached. In the lower left insertion (the first infant delivered), the insertion was battledore,

while in the second, which lay on the lower right, the insertion was central. The three circulations were not independent.

The postpartum course was uneventful and entirely free from pain attributable to any possible cord pressure from the dorsal kyphosis.

DISCUSSION

It is rather difficult to estimate the incidence of single ovum, or homologous triplets. Twins are found about once in ninety pregnancies, uniovular twins about once in 630. Triplets occur about once in 7,500 pregnancies, so in the same proportion one might suppose homologous triplets to occur once in about 50,000 gestations.

In 1902 Saniter found nine cases reported since 1866. Meyer, in 1923, reported two single ovum triplet pregnancies. The complication of acute hydramnios with homologous triplets was noted by Giglio in 1896, in a patient who aborted at three months. In 1902, von Braitenberg reported a primipara, aged thirty-seven years, whom he attended at the fifth month of gestation. She had acute hydramnios and delivered homologous girl triplets, 25, 16 and 21.5 cm. long. The infants and placenta were normal. In the eight cases of single ovum triplets which Saniter found preceding von Braitenberg's, there were two cases of hydramnios, neither of which was acute. In one instance the infants were normal, and in the other there was anencephaly. Other instances of hydramnios with triple pregnancy are to be found in the literature. Robinson, in 1887, mentioned a patient with acute hydramnios, who aborted three normal male infants at six months, no mention being made of their being homologous. Penney, in 1889, reported the case of a patient with triplets, hydramnios and a monstrosity. The placenta was in this case not examined; one infant was a monster and the other two were normal. Lantos cites hydramnios with a triplet pregnancy which was not homologous. Grusdew and Polotebnow, in 1898, mentioned a patient with hydramnios complicating triplets, but did not mention whether or not the ovum was single, nor did they describe the placenta. Bratkoff, in 1901, recorded an instance of acute hydramnios with triplets which appear, however, not to have been homologous. Manfrini, in 1909, reported a case of acute hydramnios with triplets in which the first fetus was an edematous acardiacus, 18 cm. long; the other two living infants, 29 and 28 cm. long, were normal. The placenta was single; the cords were inserted marginally in two and velamentously in the third. The acardiacus and second born infant had a common amnion. The author believed the acardiacus at fault.

SUMMARY

A case is reported of an homologous triplet pregnancy complicated by acute hydramnios which developed early in the gestation. No satisfactory explanation could be found for the rapid development of the excessive amount of fluid. Very careful scrutiny of the babes

and placenta failed to reveal a pathologic condition. The mother was normal aside from having a questionable Pott's disease. Her puerperium was excellent and she is now in very good health.

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THE DIAGNOSIS OF EARLY PREGNANCY BY ROENTGENOGRAPHY*

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EARLY pregnancy for the purposes of this communication may be considered pregnancy before the beginning of the sixth month of gestation. At this time usually a definite diagnosis of pregnancy can be established by the positive signs of this condition, the hearing and counting of the fetal heart sounds, the palpation of the outlines of the fetus and the recognition of its active and passive movements.

In 1921 in collaboration with my former colleague, Doctor Van Zwaluwenburg, I showed that pregnancy as early as the second month could be demonstrated by the pneumoperitoneal roentgen ray. Quite constantly it was found that the shadow of the isthmus of the pregnant uterus, or the cross section of the lower uterine segment, differed markedly from that thrown by the nonpregnant organ. Where pregnancy existed, the film shadow showed the isthmus enlarged in its long axis with marked extension into the broad ligaments.

In not a few cases the report of early pregnancy was made in the laboratory from an examination of the pneumoperitoneal film alone without previous knowledge of the history of the case or of the clinical findings. In addition through the changes in the isthmus it was possible to diagnosticate positively the presence of pregnancy in a fibroid uterus at a stage when it would not have been considered probable from the history and clinical findings.

However, in spite of our success in diagnosticating early pregnancy

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by means of the pneumoperitoneal roentgen ray, it was soon realized that the method was of little value except in the hands of those with considerable experience in the interpretation of such films. The roentgenologist as a rule had neither the time nor the inclination to acquire the technic of the method and co-operation with the obstetrician was not always possible. Again it was realized that the discomfort to the patient of the transabdominal injection of the carbon dioxide gas, even though reduced to a minimum, was enough to prevent the general adoption of this method. Morover, since the diagnosis of pregnancy depended upon the location and extent of shadows not in themselves distinctive, as are the shadows of the fetal bones, even the expert would hesitate to make a positive diagnosis of pregnancy upon this sign alone. Thus the latter would always be a probable and never could be a positive sign of pregnancy, such as the auscultation of the fetal heart and the recognition of fetal movements and the palpation of fetal parts.

For the past year our efforts have been directed toward perfecting a technic whereby some portion of the fetal skeleton could be shown on the film at the earliest possible time after the ossification centers appear in the young fetus, that is, from the end of the seventh week, when the first center of ossification appears in the clavicle according to Hess,[1] up to the end of the third month when practically all such centers have appeared.

It is generally agreed that the positive identification of the fetal skeleton by roentgen ray is *par excellence* the most positive of all the signs of pregnancy. The other signs, even the so-called positive signs, depend upon evidence furnished by the examiner who may or may not misinterpret what he sees, feels or hears. To be sure the same might be said of doubtful fetal bone shadows but positive shadows are never in doubt, not even in the minds of the laymen, accustomed as they are to the appearance of the fetal skeleton.

Our efforts, then, have been directed to the perfection of a technic by means of which fetal bones could be shown on the roentgen film before the other so-called positive signs of pregnancy are commonly elicited. For instance, the fetal heart can usually be heard by the end of the eighteenth or twentieth week of pregnancy. At this latter period it is possible to recognize the fetal parts and movements if the uterine and abdominal walls be sufficiently relaxed. Long before this period it ought to be possible to show the outlines of the fetal skeleton if certain technical difficulties can be overcome.

Probably the reason more progress has not been made in attempts to show the fetal skeleton by the roentgen ray prior to quickening is the fact that the obstetrician and roentgenologist have not cooperated properly. Up to the present time, at least, the obstetrician has either neglected roentgenography altogether or has feared to use it in preg-

nant women on account of its effect upon the fetus. The last question has been answered practically by the results of thousands of diagnostic exposures where no appreciable harm resulted in either fetus or mother. It must be borne in mind that there is a vast difference between diagnostic and therapeutic roentgen ray dosages. Doctor Preston M. Hickey, head of the department of Roentgenology in the University of Michigan, has figured that the current for ordinary diagnostic roentgen ray work is not more than a fiftieth as strong as that used for therapeutic purposes where bad results have been reported, so far as the early embryo is concerned. He assures me, and is supported by the best roentgenologists, that there is absolutely no danger to the fetus at any stage of gestation provided the exposures be short and not too frequently repeated.

Theoretically it ought to be possible to demonstrate the fetal centers of ossification with the fetus *in utero* as early as the seventh or eighth week of gestation since this can be done with the fetus outside the uterus. Practically, there are certain difficulties always present which may postpone such demonstration until later no matter what may be the refinements in technic. The thickness of the abdominal wall of varying degrees in different women offers one difficulty. The maternal tissues are much denser than the structures of the young embryo, so that with the best of screens, with the voltage and exposure necessary to penetrate the tissues of the abdominal wall the ray may pass through the newly formed bones of the young fetus without showing them on the film. So far as fetal skiagrams are concerned this is a distinct disadvantage and unfortunate, for it is just in the cases of obese abdominal walls where the difficulties of roentgenography are enhanced or in some cases insurmountable, that the greatest difficulty is experienced in making a diagnosis of pregnancy by bimanual examination.

Again, the embryo is surrounded by amniotic fluid which may give rise to scattered radiation and offer a decided hindrance to the penetration of the ray with a tendency to fog the film.

While the sign of internal ballottement is not usually obtainable before the beginning of the fourth month of gestation, there is considerable movement of the fetus in the amniotic sac some weeks before this time. This movement of the fetus within the sac may occur at the time of taking the skiagram, which may be an additional cause of failure of fetal roentgenography in the early months of gestation. Furthermore, it may explain why success and failure are noted at apparently the same stages of gestation and with practically the same technic under seemingly identical conditions.

Up to the fourth month of pregnancy, the uterus is practically a pelvic organ. In order for the ray to reach the fetus, it must be directed in the axis of the pelvis, the plate being placed at the pelvic outlet in

order to avoid the bones of the sacrum. Thus it can be seen that the ray must not only pass through the thickness of the abdominal wall but through the soft tissues of the uterus and pelvic floor as well. This means a considerable absorption of the ray, estimated by Bartholomew[2] and his associates as sixty per cent.

It is one of the cardinal rules of roentgenography that the object to be filmed shall be nearest the plate. One reason for the clearness of the pneumoperitoneal films was that the pelvic organs were tilted forward by the knee-chest position so that they were nearer the plate. Attempts to use this position without the artificial pneumoperitoneum in obtaining skiagrams of the young fetus have not been successful, presumably because the organs do not fall forward without the aid of the gas. In the technic employed at present, that is, the directing of the ray from above in the axis of the pelvis the plate is quite far away from the fetal parts, which may account in an appreciable degree for some of the failures.

Since the density of the fetal structures, the amniotic fluid surrounding the fetus, the movements of the very young embryo, the tissues of the pelvis, uterus and abdominal wall, are facts necessarily unchangeable, it would seem as if better roentgenographic results could only be obtained by some change in technic whereby the plates can be placed nearer the object to be filmed. This is the problem Doctor Hickey and I are working upon now with the expectation of reporting our results later.

In the present communication we wish to report the results of twenty-two roentgenograms of pregnant patients whose gestation periods ranged from between two and three to between five and six months.

They were not selected cases but patients who presented themselves at the hospital clinic with symptoms referable to the pelvis. Some were sent in for diagnosis, others for operations such as the removal of fibroids. While it was not always possible to make a positive diagnosis of pregnancy, the latter condition was thought probable in all the cases and either absolutely proved by the roentgen ray, the fetal heart or fetal movements or the patients were demonstrated to be pregnant by the subsequent histories.

The twenty-two cases have been divided into groups according to gestation periods. Each case has been assigned to a group after a careful consideration of all data available for that particular case, such as the date of the last normal menstrual period and the position of the fundus in relation to the pubes or umbilicus. It has been felt that the gestation period could only be approximated and not definitely settled. The gestation period certainly cannot be determined by the height of the fundus above the pubes or, its relation to the umbilicus, since the size of the uterus may be influenced by too many factors such as multiparity, amount of amniotic fluid and the size of the fetus. It is also

well established that the relative position of the navel varies in different individuals which prevents its use as a fixed point to be used in establishing the gestation period through the height of the fundus. It is well known from common experience that the estimation of the probable date of confinement or the period of gestation from the beginning of the last normal menstrual period may or may not be correct. Experience is invaluable in arriving at conclusions as to the period of gestation, but the impossibility of knowing in each case the time the ovum and spermatozoon met will always prevent more than an approximate estimate of the duration of pregnancy.

Hence, the cases have been grouped not exactly but approximately as follows:

GROUP	GESTATION PERIODS IN MONTHS	NUMBER OF CASES	POSITIVE ROENTGEN-RAY FINDINGS	NEGATIVE ROENTGEN-RAY FINDINGS
1	2-3	1		1
2	3-4	8	3	5
3	4-5	6	3	3
4	5-6	7	7	
		22	13	9

The gestation periods are arranged from the beginning of a month to the beginning of the next. For example, group 1 means from the beginning of the second month, that is, from the second date when the menstrual period should have appeared to the third of such dates.

When there was any doubt about the period of gestation the case was placed in the higher rather than the lower group because we were trying to find fetal bones by the roentgen ray as early in gestation as possible. In only a few cases was it possible to check up on the gestation periods by reckoning back from the date of confinement. Even by this method errors may creep in because of the possibility of the prolongation of pregnancy, the extent of which cannot be estimated.

As would be expected the proportion of positive roentgen-ray findings increases with the advance in the gestation period. In the single case between the second and third month subjected to the ray there were negative results, as would be expected. While the ossification center in the clavicle starts at the seventh week, under the difficulties of fetal roentgenography mentioned above, probably for all time to come it will be a waste of effort to attempt to show fetal bone shadows between the second and third month gestation period. However, each case should be carefully scrutinized and if there be any doubt as to whether it should be placed in the first or second groups, it should be given the benefit of the doubt, placed in group two and subjected to the ray.

In the second group, eight in number, where the patients were from three to four months pregnant, positive bone shadows were found in three out of eight cases. In the next or third group, gestation period between four and five months, six cases in all, the findings were positive

in three or one-half of the cases. In the last or fourth group, seven cases in all, between five and six months pregnant, there were seven positive findings or one hundred per cent.

We wish here to acknowledge indebtedness to Doctors Stein and Arens,[3] of the Michael Reese Hospital of Chicago for their uniform kindness and courtesy, and for their aid in our work. It was the demonstration of their success with fetal roentgenography that impelled us to take up this work. Starting with their technic the latter has been modified as our own experience increased. It is with some hesitation, however, that we report our results in this very interesting field in the light of their great experience with over four hundred cases. They state that out of these cases in only three were they sure with roentgenography of the fetus before quickening. Horner[4] reports two hundred fifty cases in which the roentgen ray was employed in pregnancy at the Chicago Lying-In Hospital and states that his youngest fetus was of five months. He thought that the fetus could not be demonstrated before quickening. Bartholomew[2] and his associates as a result of roentgenography with twenty-four patients could only obtain a fetal roentgenogram from the beginning of the fifth month of pregnancy. As a result of their investigations they concluded that fetal roentgenography was uniformly negative during the third month of pregnancy or during the period here designated as group two, from the beginning of the third to the beginning of the fourth month of pregnancy. O'Donnell[5] states that the fetus can be clearly determined from the fourth month but he does not mention cases or give his technic. In a recent article Edling[5] gives results with early roentgenography in 19 cases which undoubtedly are the most successful of any published. His previous work in this connection has been criticised as inaccurate in that he did not give sufficient data regarding the date of the last menstrual periods or the height of the fundus. It must be remembered that Edling[6] has had an unusual obstetrical material to draw upon as many abnormal maternity cases are referred to him for roentgenography from Essen Moeller's clinic. In the paper referred to he says he has examined two hundred seventy pregnant women by roentgenography, not as a routine but to answer questions arising from facts connected with these cases.

Even allowing for certain errors in estimating the periods of gestation, and as has been pointed out, all such estimations are likewise liable to be in error, the positive results in Edling's[6] series of early fetal roentgenograms are very striking.

There were nineteen cases of early pregnancy examined by roentgenography with the following results: Two were under three months and were negative, as would be expected. Evidently Edling[6] does not include these among the nineteen cases where results are as follows:

third month, 3; between third and fourth month, 7; fourth month 7; between fourth and fifth month, 4. All these save one gave positive fetal roentgenograms, certainly a remarkable showing and makes it quite imperative that Edling[6] publish his technic in detail so that others may profit by it.

While pregnancy was suspected in all the twenty-two cases reported, the usual positive signs of pregnancy were absent except in five cases where the fetal heart sounds were heard and counted. It was absent in the eight cases in group two between three and four months gestation, present in one case in group three, and in four cases in group four. In other words, while we were quite sure the patients examined were pregnant, in only five cases except for the evidence of the roentgenogram were we positive the patients were pregnant. This is a sufficient answer to those who decry any new method of diagnosis, on the ground that the older tried methods are being pushed into the background and that soon the diagnosis of normal and abnormal obstetrical conditions will be made in the roentgen ray laboratory.

The technic used in the twenty-two cases reported varied according to the weight of the patient, the thickness of the abdominal wall through which the ray had to penetrate and the period of gestation in which it was attempted to demonstrate the fetal roentgenogram. The kilovoltage varied from 45 to 55, the milliampereage between 20 and 30. The spark gap was from 5 to 6 inches and the focal distance varied from 28 to 30 inches. Time of exposure varied from 8 to 12 seconds and double screen superspeed films were used in addition to the Potter-Buckey diagram.

While the great advantage of a positive sign of pregnancy, obtained by the roentgen ray, at a period of gestation too early to elicit the other positive signs of pregnancy should be apparent to anyone, it may not be amiss to report two illustrative cases.

The first case is that of a young unmarried woman, aged twenty-two, who came to the clinic for amenorrhea of between three and four months' duration. She denied exposure but the breasts were enlarged and colostrum could be expressed from the nipples. The cervix was softened and connected with an enlarged uterus rising halfway to the umbilicus. Neither the fetal heart, fetal parts, nor fetal movements could be elicited. The clinical diagnosis was pregnancy, nearly four months. Roentgenography showed fetal bones present. Confronted with the absolute proof of her true condition, the patient confessed exposure and subsequently was delivered at the maternity clinic at which time the approximate date of the gestation period at which the roentgenogram was obtained was confirmed.

Clinically we were quite sure this patient was pregnant but we were not positive until the fetal roentgenogram was obtained. To be sure the experienced examiner is so positive in his own mind that patients like the one in the case cited are pregnant that he makes very positive statements, but he does so without the positive signs of pregnancy being present and surely may be mistaken in his conclusions. Still he much

prefers a positive diagnosis backed by undoubted signs of pregnancy. So much so is this the case that the usual procedure is to state that he thinks pregnancy is present or that he is quite certain but that in another month, since exposure is denied, the diagnosis will be absolutely established by the presence of the positive signs of pregnancy.

The weakness in the roentgen ray sign of early pregnancy is its uncertainty with the present technic. If fetal bone shadows are shown earlier than the other positive signs of pregnancy appear, the patient is pregnant beyond dispute. However, negative findings up to the beginning of the sixth month of gestation are very far from being conclusive, as shown by our work where there were five negative roentgenographic findings out of eight patients pregnant between three and four months, as absolutely proved by their subsequent histories. However, the fact that the present roentgen-ray technic is unsatisfactory in this class of cases does not mean that there exist reasons for such failure impossible to overcome by improvements in technic.

The second case is that of a married woman of forty-four who applied to the clinic for loss of strength, prolapse, and a tumor thought to be a fibroid by her family physician. The patient had had four living children and was positive that she was not pregnant, explaining her five months' amenorrhea as due to the change of life. Examination showed the clinical signs of pregnancy between five and six months but neither fetal parts nor the fetal heart sounds could be elicited. Roentgenography showed a fetus with an estimated development of between five and six months. Although this patient had been very indignant at the suggestion of pregnancy, stating she knew from her experience more than the examiner and that her physician had sent her to the hospital to have a fibroid tumor removed, she was immediately convinced and mollified when shown the fetal skiagram.

Since roentgenography demonstrates pregnancy long before the fetal heart can be heard, it behooves the surgeon to make use of this diagnostic sign at the time of the menopause before attempting the removal of what is apparently a fibroid tumor. Many good surgeons have been deeply humiliated by discovering their mistakes after the abdomen has been opened. Furthermore, in case of such an error, it is questionable how much longer they will be held guiltless if roentgenography has not been employed prior to the operations.

CONCLUSIONS

1. Roentgenography is a valuable aid to the obstetrician in making a positive diagnosis of pregnancy before the other positive signs of pregnancy are present.

2. With the present roentgenographic technic, no fetal skiagram can be obtained before the beginning of the third month of gestation.

3. Negative roentgenography will exceed positive findings between the beginning of the third to the beginning of the fourth month of gestation.

4. At least one-half the roentgenograms should be positive from the fourth to the fifth month of gestation and all should be positive beyond this period.

5. A positive skiagram of the fetus *in utero* is proof positive of pregnancy even before the gestation period when the other positive signs of pregnancy can be elicited.

6. The reverse is not true for with present technic negative findings before the beginning of the fifth month do not mean that the patient is not pregnant.

7. Beginning with the third month of gestation roentgenography should be employed in doubtful cases as an aid to diagnosis, since with the proper technic no harm will result to either mother or fetus.

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Society Transactions

AMERICAN GYNECOLOGICAL SOCIETY

FORTY-NINTH ANNUAL MEETING

HOT SPRINGS, VA., MAY 15, 16, and 17, 1924

(Continued from November)

DR. JAMES R. MCCORD, Atlanta, Ga., (by invitation) presented a report on **The Results Obtained in a Conservative Teaching Clinic Among Twenty-five Hundred Negro Patients.** (For original article see page 723.)

DISCUSSION

DR. RAYMOND E. WATKINS, PORTLAND, OREGON.—The outstanding feature of this paper is the high mortality from toxemia and sepsis. With 30 to 35 per cent of the cases having a four-plus Wassermann complicating pregnancy, it is no wonder that there is a high mortality, for undoubtedly syphilis as a complication would increase the gravity of the situation.

Our experience in the West with the negro is very small but we have found that the percentage of contracted pelves in the black woman is greater than in the white. This is compensated for, however, by the fact that the babies are usually smaller and their heads mold more readily.

I do not believe that Dr. McCord can be accused of being radical if one compares his percentage of operative procedures with those of other clinics. He has been extremely conservative. It would be interesting to know what percentage there was of injuries to the perineum and cervix and whether the cervix was repaired at the time of delivery and the results.

DR. C. JEFF MILLER, NEW ORLEANS.—I would say that Dr. McCord's presentation is a very good report from material that is unusually bad. I can appreciate the conditions under which he produced his results because for a number of years I worked in a similar clinic and in a general way I can say that the percentages which he states tally fairly well with the results obtained at the New Orleans Charity Hospital, where we have a large obstetrical clinic for colored patients.

There are a few points which I think might be mentioned in justification of some of the results Dr. McCord has reported. Colored patients make excellent teaching material, and in spite of a general impression to the contrary are fairly good surgical risks, but the trouble is that they do not apply to the clinics, as do the whites, until they are forced to by real inconvenience or pain. Indeed, the majority come only for relief from pain, and it will take considerable education to have them take advantage of the prenatal clinics and obtain the good results that come from routine observation. For this reason our services in the delivery wards will always show a large percentage of bad material.

Dr. McCord's paper gives us some valuable data in the study of the comparative incidence of disease in the negro and white races, a study which is always

of extreme interest and which has been gone into rather thoroughly by Matas, Corson and others.

When I was asked to discuss this paper I took occasion to review hurriedly the statistics of 5,500 deliveries covering a period of ten years at the New Orleans Charity Hospital, and including premature as well as full term labors. The maternal mortality in this series was 2 per cent, while the fetal mortality was 9 per cent. In a large number of cases, no fetal heart sounds could be made out when the mother was admitted, and the corrected fetal mortality would therefore be appreciably lower. The negro woman does not stand the strain of a toxemia as well as the white, and this is one explanation of the high maternal mortality. Syphilis, of course, was encountered much more frequently in the colored service than in the white, but my personal experience has been that it does not increase the maternal mortality to any marked degree. Forceps was applied 76 times, an incidence practically coincident with Dr. McCord's figures; cesarean section was done in 53 of the cases, not quite one per cent, and craniotomy in four cases. There were 219 cases of retained placenta.

I believe that the statistics of forceps operations do him an injustice; a study of the cases will show in many instances that the catastrophe was due to other causes than the application of the forceps. The high mortality for the double forceps operation also has extenuating factors. I have frequently resorted to this procedure, and while I am not enthusiastic about it, I believe that if it is carefully done the results are usually satisfactory. The statement that such cases would be better delivered by version I believe is open to debate. The case which has advanced far enough to make a forceps application possible is often a treacherous one in which to employ version, and I think the results in advanced labor are more disastrous with version than with forceps.

DR. HERBERT M. LITTLE, MONTREAL, CANADA.—Dr. McCord's report, deals with, what seems to be incomparable clinical material; and his results should be very acceptable to many members of this Society who always at least *talk* conservatism: yet, so far as the actual statistics are concerned, I doubt if the results obtained would have varied greatly for the worse even with the most radical treatment.

The previous speaker has discussed the question of infection and mortality in negro localities. It is doubtful if this is different elsewhere. Recently in correspondence with Dr. G. W. Mosher, regarding the causes of death in labor, I looked up an old paper written some years ago with a view to determining the causes of death in labor, and then checked the result with the statistics of sixteen years in the Montreal Maternity Service; and found that, in each instance, approximately 44 per cent of deaths were due to toxemia, 35 per cent to 40 per cent to infection, and the balance to accidents of labor—hemorrhage, rupture of the uterus, etc. Infected cases admitted from outside may, undoubtedly, increase mortality, but are of inestimable value for the formation of clinical judgment.

The results from the application of forceps are not good, and I think that a marked increase in the number of applications might have given a corresponding decrease in unfortunate results. A number of the forceps deliveries are classed as Scanzoni operations. Properly undertaken, the application of the blades of the forceps to the sides of the head, arrested in R.O.P. or L.O.P., followed by moderate downward traction will, in a very large proportion of the cases, result in rotation of the head forward, necessitating removal and re-application of the forceps for a simple delivery. If however, the first application is conceived primarily as a rotation maneuver, there will inevitably be reports of serious damage to the base of the bladder and to the urethra. How a Scanzoni operation could

be necessary in a patient with a flat pelvis, where the head engages transversely, I confess I do not see.

It is fashionable to condemn version, but ability to perform version properly is the hallmark of obstetric competence. When the operation is undertaken after an attempt with forceps, particularly when the results of forceps application are as shown, it is no wonder the operation has been a 100 per cent failure.

I do not understand the frequency of hemorrhage, and might repeat that the fear of hemorrhage is one of the most important factors in its causation. In the last fifteen years I remember once packing a uterus for hemorrhage, and I have used Momberg's tube perhaps twice. This infrequency of severe hemorrhage I ascribe to the frequency with which we practise episiotomy,—a median episiotomy allows of a very simple and satisfactory repair during the third stage without additional anesthesia. In 99 per cent of the cases the placenta separates spontaneously, and there is no necessity for the administration of pituitrin. Manual removal of the placenta may occasionally be necessary, but our experience with this operation, gained largely from its use in association with vaginal hysterotomy in cases necessitating rapid delivery, has proved that, if carefully performed, it is devoid of danger.

DR. E. P. DAVIS, PHILADELPHIA.—Forty per cent of the clinical material at the Jefferson Hospital is negro, and we have few of the old pure breeds but many of the degenerate negroes. Our experience is briefly as follows: contracted pelvis is common among them, and in estimating the size of the pelvis one must remember that the sacrum is often unusually thick and that one will get very little information by external examination and must supplement it by palpation.

While some of the negro babies are small, some of them have a very thick cranium and that adds to the difficulty and may sometimes make vaginal delivery impossible.

In our experience the negro has syphilis, tuberculosis, or gonorrhea,—one, two or all three of them,—habitually in the pelvic premises, and we consider them as potentially and practically infected as they come under our clinical observation. A form of infection which is especially interesting and not uncommon, and which explains the toxemias of the negro, is the chronic infection of the small intestine. We have had two cases die after complicated labor, where a thorough autopsy was made. The genital tract was sterile but the small intestine was infected and the lesions resembled somewhat the typhoid Peyer's patches, although typhoid was ruled out by bacterial examination.

Negroes will come to a prenatal clinic and will frequently follow directions remarkably well both before and after deivery; they are reasonable, tractable and good clinical material. Our management of them is usually to do as little to them as possible; we watch them closely and see what happens; by all means getting the head through the brim of the pelvis by natural force if possible. If we do interfere, we do so under thorough surgical precautions, guarding against hemorrhage and securing very free drainage of the uterus.

In performing abdominal section on the septic negress, we do a supravaginal hysterectomy, leaving the stump outside the abdomen, while in the white woman we take a greater chance and save the uterus.

DR. GEORGE W. KOSMAK, NEW YORK.—For a Northerner to venture any opinion on the delivery of negroes might seem out of place, and yet with the large influx of negroes into our cities during the past few years we have come in contact with this problem. At the New York Lying-In Hospital the very large increase of negro patients has made us rather skeptical as to the effect on our statistics insofar as complications were concerned, but strange to say, and happily so, there

have been no bad results introduced. We find that these negro patients seem to go through labor very satisfactorily and, as Dr. Davis has said, they are very tractable. We find no difficulty in getting them to come to our prenatal clinic or to follow directions afterward. A great proportion of them, it is true, have deformed pelves. The flat pelvis is very common, but in most of these cases the baby's head is so soft that delivery is not so complicated as it would seem from the preliminary mensuration.

The low incidence of forceps deliveries in Dr. McCord's cases is rather striking. If more of these women could have been delivered by forceps, possibly the final results would have been better.

As regards toxemia, I do not believe that applies to the North. Whether the diet has some influence I do not know, but we do not have as large a porportion of toxemias among the negroes as we do particularly among the Italian and Jewish races.

It is my belief that if the head refuses to go through by the usual route, there is very little better chance of getting it through by version, and I am inclined to disagree with the commonly accepted statement that version is an easy process. I believe that more care should be taken in the application of forceps.

Dr. McCord demonstrated quite conclusively that better prenatal care is needed among these women and if that can be accomplished in the next decade and their general hygiene can be corrected, I think his later results will show great improvement. This would include the recognition of syphilis and gonorrheal infections, as well as all constitutional conditions, and if these can be properly noted and cared for I am sure that when the Doctor presents his next 2500 cases his general results will be very much better than in this series.

DR. C. H. DAVIS, MILWAUKEE, WIS.—Is it not possible that the length of the labor may have something to do with the lowering of resistance in the women and the increase in sepsis? May I suggest that in all of these potentially infected cases the head of the bed be elevated, keeping it elevated for four or five days, to aid in drainage.

In potentially infected cases, I like to use a mercurochrome solution to thoroughly cleanse the vagina. Any of you who have made cultural studies after using mercurochrome will agree that it gives us great advantage in these cases.

DR. WILLIAM R. NICHOLSON, PHILADELPHIA.—It is very likely that I may have a better realization of the work represented by this paper than most of those present, since I have done a great deal of work in the control of the midwife situation in Philadelphia, and therefore I realize the difficulties with which the essayist has had to contend. Of course his material was of a very low physical type, which explains certain of his results. My figures are very different because I deal with what might be called "selected risks."

There is certainly a lack of understanding upon the part of the government as to conditions as they actually exist. If animals were being raised for breeding purposes by the government the greatest care would be exercised, the best possible quarters would be supplied, and also the best sort of attention. In the question of childbirth, however, this is not the case. If facts, as they are, could be presented to the public, there would be a demand for reform so insistent that it would have to be given the most careful attention. A large sum of money would be required, but if this were forthcoming, statistics could be produced which would astonish the world. My own experience in a large city overseeing some 6,000 to 8,000 cases a year, has proved that to me beyond the peradventure of a doubt.

DR. JOSEPH B. DE LEE, CHICAGO.—Dr. McCord need not fear to present his records before us. The Germans say "Vor den Wissenden sich stellen, besser ist in allen Fällen." "To present your cases before those who know is the best possible procedure." At the Chicago Lying-In Hospital our percentage of negroes has gone up tremendously in the last two or three years, and also the mortality and morbidity statistics, contrary to what Dr. Kosmak has said regarding New York.

I believe the modern woman cannot so well meet the demands of civilization. Probably the negro in a natural environment would not have eclampsia, but transferred to our modern conditions she develops all forms of toxemia.

I was surprised that Dr. McCord did not show a larger percentage of contracted pelves. Our percentage of positive Wassermann reactions has gone up from 4.1 per cent six years ago to 11.5 per cent in the last year. I approve very decidedly of his conservative treatment of these cases and I would hesitate to contemplate the effect on that clientêle of the radical and interfering methods that are more or less prominent in the North.

DR. MCCORD (closing).—Most negro labors are short. The fetal mortality is very high. 50 to 60 per cent of our cases attend prenatal clinics. I am a better version operator than I am a forceps operator.

DR. JOHN O. POLAK AND DR. SAMUEL WOLFE, Brooklyn, N. Y., presented **A Further Study of the Origin of Uterine Bleeding in Tubal Pregnancy.** (For original article see page 730.)

DISCUSSION

DR. E. A. WEISS, PITTSBURG, PA.—It is generally accepted that there is a uterine decidua vera no matter where the ovum is implanted and develops. It has also been taught by many that the bleeding attending ectopic pregnancy came both from the uterus and the tubes as well.

Sampson's most excellent work with injected specimens of uteri removed with ectopic pregnancies showed us that the uterine bleeding in all cases was distinctly of venous origin and came from the endometrium and at no time did it issue from the tube into the uterine cavity. Dr. Polak's observations and close study do not seem to substantiate all of Sampson's conclusions, for he has demonstrated that in many cases there is an actual discharge of blood from the tubes into the uterus.

Since the publication of Sampson's work on this subject we have endeavored to satisfy ourselves as to the clinical application of his observations made with injected uteri. In tubal abortions it is reasonable to conclude that there will be little or no back flow into the uterus from the tube but a different condition exists when the pregnancy is near the cornu, because histologic sections have shown us that the tubal mucosa at or near the uterus closely resembles uterine mucosa, especially after decidual transformation, so that even after total or partial expulsion of the uterine decidua, there may be tubal bleeding into the uterus.

The occurrence of vaginal hemorrhage usually indicates death of the embryo. Such bleeding may persist even after the primary shock. While not severe, such wasting sometimes persists and can be attributed, as Polak has pointed out, to the possibility that some of the chorionic villi are still alive and exert a stimulating effect by producing a new decidual reaction in the uterus.

Experience has shown us that tubal pregnancy is not always terminated at the time bleeding occurs. A recent case in point is that of a patient operated

by us for extrauterine pregnancy 12 years ago. After nine years of sterility and practically normal menstruation there was amenorrhea for eight weeks, but as the patient was then 44 years old she believed herself entering the menopause and did not seek medical advice. A persistent and rather free bleeding for five days accompanied by clots and shreds and attended with labor-like pains, was likewise disregarded. Then after six weeks more, with no bleeding a sudden violent attack of pain occurred. Recalling then her first attack of 12 years ago, the patient applied to the hospital, having diagnosed her own condition. Operation revealed an ectopic in the other tube of at least 3½ months and fetus living, showing quite clearly that death had not occurred when she had vaginal bleeding six weeks previously.

Dr. Polak has observed that many tubal pregnancies are operated before the pregnancy is terminated. This has not been our experience. We believe that only a very small percentage are operated before rupture or abortion and in a review of over 250 of our personally operated cases only 11 or less than one half per cent did not have abortion or rupture or at least some peritoneal bleeding, for we believe that blood in the peritoneal cavity in the presence of tubal pregnancy is a more constant sign of death of the embryo than is uterine bleeding.

We are still of the opinion therefore and agree with Dr. Polak that bleeding in ectopic is mostly from the uterus and to a lesser degree from the tube.

DR. HENRY T. BYFORD, CHICAGO.—Did the bleeding after curettage stop earlier than in cases not curetted? My idea was that the tears in the pelvic peritoneum about the tube kept up the flow after the death of the fetus, and in that case the curettage would disturb things more and be followed less promptly by cessation of the flow than otherwise.

DR. JOHN A. SAMPSON, ALBANY, N. Y.—The paper which I presented before this Society in 1913 was based on the study of twenty-five uteri which had been removed, together with the tube, containing an extrauterine pregnancy. The veins or arteries of both of the uteri were injected in order to determine the changes in the blood supply of the uterus caused by the tubal pregnancy and also to detect the source of the uterine bleeding usually present in these cases. The endometrium of all the uteri was studied histologically and in many cases it was similar to that obtained from the uterus of an early uterine pregnancy which had been terminated but all of the products of conception had not escaped from the uterus. In the latter cases uterine bleeding is usually present. It may be profuse, scanty, more or less continuous or intermittent. The interesting feature is that if we curette the uterus to remove all the products of conception the bleeding usually ceases almost immediately. I compared the condition of the uterus of tubal pregnancy removed by operation with that found in a terminated early uterine pregnancy in which all of the products of conception had not been removed. In both cases a condition of subinvolution of the uterus is present. In the tubal pregnancy the products of conception, usually still present in the tube, exert upon the uterus the influence of pregnancy and interfere with the involution started by the termination of the pregnancy.

There was no difficulty in demonstrating that the uterine bleeding was of venous origin and arose from the endometrium. In none of my cases was I able to show that the uterine bleeding sometimes arose from blood escaping through the lumen of the tube into the uterine cavity. My inability to demonstrate this may have been due to several factors. Only twenty-five uteri were studied and it may be a more infrequent source of bleeding than the uterine mucosa or possibly

the uteri were not removed at a time in the course of the tubal pregnancy when this type of bleeding occurs. Another factor is that it is very difficult to inject the blood vessels of the tube in tubal pregnancy because there is so much leakage from the vessels of the tube injured by the termination of the pregnancy.

I wish to thank Dr. Polak for continuing the study of this very interesting subject and for calling our attention to the fact that apparently the involution of the endometrium associated with tubal pregnancy is slower after all the products of conception have been removed than after removal of the products of conception in a uterine pregnancy; and also calling attention to the fact that bleeding sometimes occurs from the tube into the cavity of the uterus. I tried to demonstrate the latter in the experiments which I made, but was unable to do so.

DR. EMIL NOVAK, BALTIMORE.—Dr. Polak agrees that it is the death of the embryo which is responsible, in most cases, for the involution of the endometrium and the appearance of the external bleeding. This is not surprising when one recalls the mechanism of normal menstrual bleeding. The premenstrual hyperplasia in the endometrium continues until the death of the ovum, which has been thrown off some two weeks previously. When the ovum dies the pregravid endometrium, which has been prepared for it, involutes and is cast off, with the bleeding which we call menstruation. So long as a live embryo is present this involution is inhibited. This was illustrated in a case which I observed of combined intra- and extrauterine pregnancy. The patient had all the signs of cataclysmic abdominal hemorrhage but there was no external bleeding whatsoever. A ruptured tubal pregnancy was found. At the time of the operation the uterus was only slightly enlarged and no special attention was paid to it. Some weeks after the patient was sent home I received a letter from her doctor saying that she had just aborted, expelling a fetus of about three months' development. In other words, she had had a live fetus in the uterus at the time that she was operated upon for the ruptured tubal pregnancy, and the presence of this live fetus had inhibited uterine bleeding.

Dr. Polak suggested that, in certain cases, external bleeding is due to the escape of blood into the uterus from the uterine end of the pregnant tube. He has studied the question very intensively, but I believe that it will merit even further investigation. A recent patient had had vaginal bleeding for six weeks. On opening the abdomen there was a smooth unruptured tubal gestation, without a drop of blood in the pelvis. If the external bleeding had been of tubal origin it seems hard to believe that there would not also have been some bleeding through the open end of the tube into the abdominal cavity. Finally, I agree with Dr. Polak in his statement that the endometrium goes through a form of involution comparable to that seen in the case of uterine pregnancy. The diagnostic value of the microscopic examination of the curettings in cases of tubal pregnancy is thereby very much lessened, because so frequently, after the death of the fetus, only a normal endometrium can be found with little or no trace of decidual reaction.

DR. DOUGAL BISSELL, NEW YORK.—Ectopic gestation may complicate intrauterine pregnancy and may be alone recognized. Under these circumstances, if the regular uterine bleeding is treated by curettage and packing, the normal gestation must be sacrificed. My practice therefore is not to curette preceding the operation for the removal of ectopic gestation because it is altogether unnecessary, as nature automatically stops the uterine discharge if the ectopic alone is the cause of it. To curette consumes time with loss of blood and there is the additional risk of removing a normal conception. By not curetting, I was enabled

in one case to save and carry to full term an intrauterine conception of the same age as the ectopic which complicated it.

DR. EMIL NOVAK, BALTIMORE.—I believe that Dr. Bissell misunderstood my interpretation of this case. The symptoms pointed definitely to ruptured tubal pregnancy of the tragic type, except for the absence of vaginal bleeding.

DR. J. C. LITZENBERG, MINNEAPOLIS, MINN.—I want to correct Dr. Polak's quotation of mine. Yesterday I pointed out the presence of blood in the tubes, but I did not say it was going into the uterus; in fact, I believe it was not. The slides showed no connection between the hemorrhage at the site of the ovum and the blood in the tube. I am convinced that the term "tubal abortion" is a misnomer and should be called "internal rupture," because in none of my collection of pregnant tubes have I ever been able to find a separation of the ovum, but have always been able to find a rupture of the internal capsule into the lumen. Even when we see the ovum bulging from the end of the tube, I think it is simply growing in the direction of least resistance. I do not believe a tubal pregnancy has ever been expelled by the musculature of the tube, because it is anatomically impossible.

DR. CAREY CULBERTSON, CHICAGO, ILL.—There is one point that I believe may be a factor in continued bleeding which has not been brought out, and that is the reappearance of menstruation. Some of these cases are of long duration; the patient may have been sick for five or six months from the beginning of the pain, the time at which the hemorrhage probably took place. We know that after abortion it sometimes requires two or three months before the menstrual cycle begins to be reestablished, and the same may be true after ectopic bleeding; the patient is carrying what might be regarded as a chronic hematocele, and in some measure the bleeding may be due to an attempt to reestablish the menstrual cycle.

Dr. Litzenberg brought up the subject of nomenclature with respect to rupture and abortion. I agree with him that these cases are not abortions in the sense that we have uterine abortions. I had one case, and have seen one other, in which the gestation sac was hanging out of the tube as if it were being squeezed out. In that case the chorionic villi were attached to the edges of the fimbriae. I have seen two cases with the same villous attachment, in which there were no sacs at all, but extensive hematoceles had developed.

DR. POLAK, (closing).—I do not wish to be misconstrued in this study. It is only a preliminary report and the observations are being continued. We are trying in each individual case to correlate the intrauterine findings at different periods with the tubal findings and the clinical history, and we believe that ultimately something will throw light on exactly what happens.

There is no doubt that what Dr. Sampson has worked out, takes place in the majority of these cases, but what we are trying to find out is what happens inside the uterus. In one case of interstitial pregnancy we have positive proof that the bleeding came in that instance from the uterine end of the tube.

In regard to the question of abortion, these cases, depending entirely on what our conception of that condition is, all show a hemorrhage into the intervillous spaces which is so excessive that it proceeds into the capsule and causes an unrest of the ovum, and not until then do we get bleeding.

The intraabdominal bleeding through the abdominal ostia, in most cases, is due to the very large proportion in the free end of the tube, and we get no hemorrhage on the proximal side. It is only in the interstitial cases that we claim there is bleeding from the tube into the uterus.

DR. H. C. BURGESS, Montreal, Que., (by invitation) presented a **Clinical Consideration of the Contracted Pelvis.** (For original article see page 739.)

DISCUSSION

DR. WM. E. CALDWELL, NEW YORK.—Probably due to the large number of negro and foreign women in our Clinic we seem to have a larger number of contracted pelves than Dr. Burgess reports. The standard classification of the contracted pelves is of great value in anthropologic and developmental studies but too difficult to teach and to remember and unnecessarily complicated for routine obstetrical practice. The classification which Dr. Burgess suggests covers the majority of the contracted pelves, is easy to teach and is all that is necessary for practical obstetrics.

Which type of pelvis to classify as due to rickets, is causing us a little trouble just now. In the last 7,000 deliveries there have been but two cases of advanced rickets where the spines were further out than the crests. On the other hand the typical sliding forward and rotation of the sacrum with a wide transverse outlet we have found among patients who show no other signs of rickets, and even among our West Indian women, among whom according to Hess and others, rickets does not occur.

Another type of abnormal pelvis that is found frequently in the Sloane Service, especially among women from the Balkan States, is the very deep pelvis with a symphysis of 8 cm. or more, frequently with six sacral vertebrae, a bad inclination, a narrowing of the pubic arch but usually a good posterior sagittal. Though a great many of these women deliver normally, parietal presentations, early rupture of the membranes and difficult labors are common. In this type of a case the fascial reflections are attached very low, causing a short anterior vaginal wall so that the cervix retracts with difficulty. In this type of a case version and breech extraction is usually much easier than a forceps operation.

Though the pelvic measurements are of great importance they are only one of several factors to be considered in the management of a woman with an abnormal pelvis. Her race and bony development and that of her husband's must all be taken into consideration. Distortions of the lower uterine segment caused by marked rotation of the uterus, angulation of the uterus or abnormal reflexion of the fascias so frequently found in cases of contracted pelves and which cause malposition of the child's head, are very important factors in the management of such cases. I believe that the correction of these conditions by external manipulation, binders and posture so as to make the head fit squarely into the brim of the pelvis, is not emphasized enough in our teaching of obstetrics.

When there is distinct disproportion between the child's head and the bony pelvis, cesarean section is of course indicated as the operation of choice and the perfection of the low operation has extended its usefulness in cases where, after prolonged labor, there is still bony obstruction. A child's head which will not come down as a vertex is not likely to come through by breech extraction; however, when the failure to advance is due to the misdirected forces on account of malposition rather than bony obstruction, and when the soft parts have been eliminated, there is still place for version and breech extraction or for the use of forceps. In such borderline cases when the question of dystocia can only be determined under deep anesthesia, preparations should be at hand to perform a cesarean section if necessary without unnecessary delay for, in many cases forceps and version and breech extraction have been attempted because of lack of preparations. We have had no maternal mortality in our cases of version and breech extraction or in the few cases of high forceps which we have done (19 in

4,000 deliveries) whilst the maternal mortality for cesarean section is nearly 2 per cent.

Our results from induction of labor in contracted pelves were so unsatisfactory that we very seldom use induction in contracted pelves cases.

DR. WM. C. DANFORTH, EVANSTON, ILL.—The point which Dr. Burgess made regarding the great importance of prenatal examination is one which cannot be too greatly emphasized.

I have resorted to pushing the head into the pelvic inlet in order to determine whether or not the head would be likely to pass through, in our relatively contracted cases, but have not come to have quite the same confidence in it that Dr. Burgess apparently has. It is true that it will give us an idea as to the relative size of the head as compared to the pelvis at the time at which the examination is made but it cannot tell us the degree of molding which we may expect and upon this depends in many cases whether or not the head may pass through.

I agree entirely with Dr. Burgess' idea in regard to the management of cases of relative contraction so far as the labor is concerned. We have been accustomed to deliver those cases in which it seemed certain the head would not pass through the pelvis by cesarean, using in these elective cases the classical section. In the borderline cases we usually try a test of labor and this can be more effectively tried since the perfection of the cervical section which permits us to give the patient an adequate trial of labor. Our experience with this operation has been limited because our results with these cases have been quite like those Dr. Burgess has spoken of; that is, 80 per cent of our relative contractions deliver spontaneously or at least without the necessity of any abdominal interference. Our recoveries after this operation have been very satisfactory.

Our experience with version in the contracted pelvis corresponds with that which Dr. Burgess has described and we are not inclined to favor it.

As to the induction of labor in contracted pelvis, I am not quite as enthusiastic as the essayist. I take it that the primary reason for pregnancy and labor is that a baby may be born which is not only alive but which may be brought up. It requires very careful judgment when induction of labor ahead of term is used not to obtain a certain percentage of babies which by reason of prematurity are compromised. We prefer therefore particularly in primiparae to allow labor to begin, using abdominal section in the minority which do not deliver normally.

Dr. Burgess emphasized the value of a simpler classification of contracted pelves. I agree thoroughly with this, and the simpler classification which he gives us would be far easier for the average practitioner to keep in mind and would be easier for students to learn.

DR. L. G. CONN, EDMONTON, ALBERTA, CANADA.—I think as Dr. Burgess does about the classification of pelves, for many students cannot learn the ordinary classification and when they go out they never make any attempt to follow it. They steer clear of contracted pelves and the result is that many of these cases are not recognized and are not handled as they should be and after all, the proper handling is the diagnosis early in the case.

DR. JOHN O. POLAK, BROOKLYN.—A point which might probably be further emphasized, is the study of the individual patient, not only for stature, but for other conditions. There are so many simple observations that suggest contraction: for instance, the length of the forearm, the shape of the thromboid, etc.

As to fitting the head into the pelvis, it is not well understood what he really means by that. That can best be done, and should always be done where the

decision is to be made between the infra-and supravaginal delivery, with the patient under an anesthetic, with the whole hand in the pelvis.

Another point of importance is the incidence of craniotomies. Gradually in the East craniotomies have dropped out of use except in some of the larger clinics, and yet there is no operation that means so much to the mother in these neglected cases that are potentially or frankly infected. I believe it is far better to do a craniotomy in those frankly infected cases than it is to take the risk of abdominal section.

DR. W. H. VOGT, ST. LOUIS, MO.—I want to endorse practically everything that Dr. Burgess has said, chiefly his method of classification; likewise his very excellent method of treating contracted pelvis.

So far as the test of labor is concerned, I am always reminded of what my old teacher, Professor Leopold, used to say, that whenever you decide to do a high forceps, don't carry the forceps in your pocket but go home and smoke a cigar and in the meantime, when you come back, perhaps the baby will be born. This is true in many cases of so-called contracted pelvis cases; we are often surprised to find the baby born. Only recently I saw a normal delivery occur when an operator was getting everything in readiness to do a cesarean section. We are frequently surprised to see what the forces of labor will do even in severely contracted pelves.

The baby, too, should be considered as well as the contracted pelvis and I think that is a thing that we are overlooking right along. I know the attempt is not generally made to obtain an exact idea of the baby's head. Personally, I believe one can get a real idea as to the baby's head in relation to the pelvis, when proper measurements are made, but when we speak, about the moldability of the baby's head, we speak of something we know nothing about. I do not believe any of us know whether a baby's head is going to mold into the pelvis or not; therefore, I believe it is necessary to know what the size of the head is in relation to the pelvis. I am convinced that we can obtain very reliable working ideas of the size of the head by external measurements as advocated by Perret some years ago. I have been practicing that method and after considerable experience find that the difference between the estimated and the true biparietal diameters does not vary over three-quarters cm.

I am likewise convinced of the fact that there is such a thing as a postmature baby, even though it is generally denied. Some tell us that babies who weigh over eight and a half pounds, are suffering from hypothyroidism. If that is a fact then there are a lot of hypothyroid babies born. I am sure that we are no longer proud of bringing big babies into the world. We used to go around boasting of nine and ten pound babies; but now we are rather ashamed to admit that, for large babies are usually delivered at the expense of the mother's health and welfare and often sacrificing the baby's life.

DR. BURGESS, (closing).—As regards Dr. Danforth not having satisfactory results by a pelvic examination under an anesthetic, all I can say is that we have found it of the greatest benefit. I attempt manually to engage the head in the pelvis, and when it is a tight fit to wait for a period of six or seven days and then induce labor.

We never think of inducing labor unless we feel that we have an excellent chance of getting a living, viable child; but when you have a borderline case, with a patient two or three weeks from term, the giving of pituitrin and castor oil, or the putting in of a bougie (which I prefer to a bag) recommends itself as a reasonable operation.

DR. THOMAS J. WATKINS, of Chicago, Ill., read a paper on **Vesicovaginal Fistula.**

Dr. Watson advocated thorough dissection of the anterior vaginal wall in the operative treatment of cystocele and called atention to the importance of noting the retraction and fixation of the injured tissues. He believed that a hopeful prognosis was possible in many cases where the vesical sphincter seemed irreparably damaged and presented a plan for obtaining adequate mobilization. In vesicovaginal fistula the tissues retract and become fixed in much the same manner as in ventral hernia and this is most pronounced in urethral injury. Deep lateral dissection is therefore necessary to obtain mobilization. Separation of the bladder from the cervix by blunt dissection is necessary only in exceptional cases. The latter is especially valuable when the fistula involves the cervix and is essential if a maximum amount of mobilization is desired. Incision and ligation of the broad ligaments can also be utilized for releasing the upper part of the bladder. This does not endanger the urethra as would extensive lateral separation of the bladder and tends to lessen the probabilities of shortening the vaginal canal. Dr. Watkins prefers closure with silkworm-gut in the form of mattress or figure-of-eight sutures or a combination of these. Tissues about all infected fistulas are not suitable for closure with buried sutures and primary union is of vital importance to the patient. In cases of involvement of the vesical sphincter deep lateral dissection and firm closure is especially important to obtain urinary continence and prevent retraction.

DISCUSSION

DR. J. WESLEY BOVEE, WASHINGTON, D.C.—I thought I had made some quite broad dissections, but this is beyond anything I have done. I am somewhat at a loss to see what the advantages are of separating the broad ligament from the cervix, unless it might be in a patient like the woman I operated upon a year ago, who weighed 240 pounds, was 68 years of age; the uterus had been removed twenty years before for cancer and the bladder had been opened and sutured, but failed to unite. Subsequent operation to close the fistula was a failure. I had great difficulty in closing the fistula. At the end of twelve days she had leakage of urine and there still is some leakage. Here I believe we should get benefit from a broad dissection of this character.

As to the sutures used, I think I have had better success with chromic catgut than with silkworm-gut. In my work I have entirely discarded everything but catgut. I used kangaroo tendon for many years, but I have not used silkworm suture for a long time, chromic sutures seeming to fill the requirements.

MAJOR P. F. GOW, IND. MED. SERVICE.—In many places in India the practice of obstetrics is still primitive and my fistula cases come not from Calcutta but from the Hills of Assam and out-lying districts where women may continue for several days in labor without any skilled assistance—the result being frequently a big vesicovaginal fistula. Further, I see many cases years after the fistula has developed and after the patient has had one or more operations without cure. This brings me to emphsize one point brought out by Dr. Watkins,—the necessity for proper instruments. These are easily procurable in America, but not always immediately available in India and I frequently find a previous operation has been attempted by a Mission Doctor under the best conditions at hand, but without proper instruments,—the result being imperfect closure, an excess of cicatricial tissue and very little healthy tissue available for a subsequent operation.

The next important factor adequately mentioned by Dr. Watkins is the free mobilization of the flaps. I have never had occasion to go as far as he has, but

the dissection must be extensive enough to allow the flaps to fall together without traction. Unless that is done there can be little hope of successful closure.

My own experience as regards the material for suture of the bladder wall has been that there is nothing as useful as silkworm-gut. To it I attribute mainly the success I have had in dealing with persistent leakage of urine where the cases have been operated on several times previously. I am very careful not to go through the mucous membrane of the bladder but only through the muscular wall, thereby leaving no nucleus for a urinary calculus but securing apposition to the edges of the opening in the bladder until firm union has occurred. I have not used chromic catgut, but have not found ordinary catgut satisfactory for this purpose in India. I noted that the catgut sutures in the vagina sloughed out within seven or eight days and in the bladder about the same time, so that although the operation gave promise of success for the first week, a leakage of urine occurred about the ninth day, whereas complete and successful closure followed the use of silkworm-gut.

I have found it beneficial to leave in a selfretaining catheter for 10 to 12 days and to wash out the bladder at regular but increasingly longer intervals.

DR. DOUGAL BISSELL, NEW YORK.—The simple principles introduced by Marion Sims in the cure of fistulae have served my purpose with uniform success during the past thirty years and I judge that the cases met with by me could not have differed greatly from those operated on by my colleagues during this time.

In the early days of gynecology, a time when the only surgery done was that for the repair of vesicovaginal fistulae, a time when there came to Sims from every part of this country and from foreign lands, cases as the records show, of every conceivable form of vesicovaginal fistula, we marvel at the dexterity our great teacher used in applying his simple principles; for his successes, as shown by the old records still preserved, would do credit to the master surgeons of today. I therefore plead for the application in general of these old simple principles in the repair of vesicovaginal fistulae and would reserve the more complicated principle of mobilizing the bladder for those cases where it is particularly adaptable. I believe, we can adopt and it is applicable, as far as I know, to every form of case unless it be the type of case that Dr. Watkins describes. This simple type can be cured without any more complicated procedure than that devised by Sims many years ago.

DR. R. M. RAWLS, NEW YORK.—Some years ago when I devised an operation for cystocele I was criticised for the extensive dissection, and was accused of doing a major operation for a minor condition. I am not going to make that accusation of Dr. Watkins, for it seems to me that in some cases where there is a destruction of the sphincter control of the bladder, such an extensive dissection as Dr. Watkins has pictured is of service. The sphincter control of the bladder is due to two muscular elements: the first is the reduplication of the muscular fibres around the neck of the bladder; the second is the action of the compressor urethra in the female.

I have rather questioned the existence in the female of the compressor urethra, but after seeing Dr. Hirst's very careful demonstration, I now appreciate the importance of its restoration.

I cannot agree with Dr. Watkins as to the line of cleavage. In cystocele I find the proper line of fascial cleavage by cutting in the midline and not off to either side as shown in Dr. Watkin's slides. The bladder can be freely separated from the fascia and remains attached only to the uterus. Then by cutting the so-called uterovesical ligament the bladder is freely mobilized even above the peritoneal

fold except for a few fascial fibres of the retinaculum of Mothri. Therefore, I cannot see the necessity of cutting or separating the broad ligament.

DR. CAREY CULBERTSON, CHICAGO, ILL.—Two points I wish to bring out: The operation as described and the pictures indicate that it is applied to the fistula that results ordinarily from obstetrical trauma. Today vesicovaginal fistulae are due as often to postoperative trauma as to obstetrical trauma. In my experience, which is similar to that of Judd, about 50 to 60 per cent of fistulae are postoperative, secondary usually to hysterectomy. The fistulous tract is usually further back in these cases, and there are certain other changes which are secondary to the preceding operation, such as the absence of the uterus, and displacement of the ligaments, —not only of the broad but of the round ligaments. If we have not performed the previous operation ourselves, we do not know where these ligaments are. The point I wish to make is that the method of dissection described by Dr. Watkins is admirably adapted to the closure of postoperative fistula.

My second point is that in preparation for the closure of vesicovaginal fistula cystoscopy should be universally employed and the charted picture of the interior of the bladder incorporated in the case history. This can be done immediately before operation for closure or some time previously. This is particularly important in postoperative fistula for the reason that the lesion is apt to be close to the ureteral orifice and the orifices, of course, are more apt to be involved in the closure of the fistula if their exact location is not known.

DR. GEORGE GRAY WARD, NEW YORK.—Dr. Watkins calls attention to the great benefit, as far as procuring mobilization is concerned, of dissecting the fascia high up on either side of the urethra.

My fortune, or misfortune, has been that I have not always been able to apply the operation of Sims where I would be inclined to do it perhaps, on account of getting cases that have had repeated previous operations, where the wall of the vagina and bladder were extremely thin, thus making it difficult to get a broad enough surface for a beveled approximation without some tension.

I wish I could say that I never have had a failure.

I can bear out what Dr. Culbertson says about the frequency of operative injuries, and they are usually of the inaccessible type. I contributed a paper before this Society on inaccessible fistula and laid down some principles which would facilitate the closure, and in that procedure the same wide separation of the bladder from the vagina and the uterus is an essential point. I have also brought out the point of using the Schuecardt incision which greatly facilitates the approach.

I think failure to reduce tension is due more often than anything else to not having proper mobilization. If there is tension around the injury, you will fail, no matter what kind of suture material is used.

DR. WILLIAM R. NICHOLSON, PHILADELPHIA.—I was particularly interested in the statement of Dr. Watkins that the fistula did not destroy the sphincter of the bladder, because I have unfortunately just had two cases in which the whole urethra had been entirely destroyed, leaving a hole about as large as a quarter of a dollar, in the bladder, close to the cervix. I attempted in one case a reconstruction of the urethra, with the idea of making mechanical pressure upon it by some variety of pessary, but failed to do more than contract the opening in the bladder and gain a certain amount by the use of the anterior lip of the cervix. In this case the introduction of a hard rubber ball pessary enables the woman to be a little more comfortable than she previously has been. Cystoscopic examination in this case showed the ureters so distorted in position that any attempt

to close the fistula with the hope of getting sphincteric control was obviously, useless.

The other case was a woman with absolute urethral destruction, the etiology of which was very obscure, probably due to syphilitic infection. She also had a tremendous abdominal hernia and was extremely fat. In her case I suggested the establishment of a permanent pessary and the wearing of a receptacle.

These two cases present extremely unfortunate conditions. It will be remembered that Drs. Noble and Kelly, and also Dr. Goodall each reported cases of this type, in all of which mechanical support had to be used after they had reconstructed the urethra; and also that Dr. Emmett had an experience with five of these cases, with very unsatisfactory results. In neither of my cases was the very interesting procedure of Dr. Ward possible of performance.

DR. GUY L. HUNNER, BALTIMORE.—I should like to know what Dr. Watkins' attitude is toward a vaginal hysterectomy in some of these extensive cases. I am always rather glad if there is some good excuse for going ahead in very severe cases and doing a total hysterectomy. It gives a better mobilization, of course, and a better chance to bring the vaginal tissues up against the bladder without the danger of dead spaces that so often develop a little leakage.

I prefer to close the first layer with plain No. 2 catgut. I believe the chromic gut sometimes lasts too long and is liable to favor infection. I make bladder closure first with catgut, because this is so pliable and you can use small needles. I always test the suture line with intravesical pressure after making the first closure of the bladder wall, sometimes making a double row closing over the first row; I am not particular whether the first row of sutures passes through the mucosa of the bladder or not. Then in the final vaginal closure I prefer pure silver wire. You can get that in smaller strands than the ordinary sterling silver wire which we have in the usual operating room equipment. The sterling silver is a little more apt to break than is the virgin silver wire. With the latter you can regulate the amount of pressure on the tissues.

DR. WATKINS, (closing).—The size of an abdominal incision has been standardized and is no longer a subject for serious discussion. It is made large enough to obtain good exposure and to permit of easy work. The amount of dissection for vesicovaginal fistula should meet the same requirements, and especially to obtain free mobilization.

The amount of traumatism suggested by the incisions of the broad ligaments, is much less than would be expected. When the cut ends of the broad ligaments are sutured together in front of the cervix no deformity should result and no injury to the supports should obtain.

I appreciate Dr. Nicholson's remarks, but still believe that continence can often be obtained in cases where the vesical sphincter seems to be irreparably damaged. The sphincter, like the sphincter in complete laceration of the perineum, is generally not so much destroyed as it is retracted and fixed.

I am glad Dr. Hunner spoke of the amount of mobilization of the bladder which results when hysterectomy is done, because complete separation of the bladder from the cervix and incisions of the broad ligaments as described give the amount of mobilization noted.

DR. GUY L. HUNNER, Baltimore, Md., presented his paper **End Results in One Hundred Cases of Ureteral Stricture.**

This report was based on the first 100 answers received from questionnaires sent to the author's first 300 patients treated for ureteral stricture, between 1910 and 1918 and at least five years had elapsed since treatments ceased. The analysis

of the clinical features as summarized from the records and from the questionnaires, gives one a fairly clear picture of the symptoms associated with ureteral stricture and of the results that may be anticipated from treatment.

That this disease has been overlooked in the past is evidenced by the past records of operations in this group of cases. Of these 100 patients 71 had records of 109 operations, 38 of the patients reporting 56 operations with total or partial relief of the symptoms for which operation was done, and 33 of the patients with 53 operations reporting no relief to symptoms.

The most common operation for symptoms due to ureteral stricture is that for supposed appendicitis. Thirty of these patients had been operated upon with the sole diagnosis of appendicitis, 28 for chronic appendicitis and two for the acute condition. Of these, four reported complete relief from symptoms, nine partial relief, and seventeen no relief.

Pain in the back was a complaint in 97 instances, and this was completely or partially relieved after ureteral treatments in 69 instances, or in 71 per cent of the cases. Pain in the lower ureteral region was recorded in 93 cases and relieved wholly or in part in 70 instances or in 75 per cent. Bladder symptoms were recorded in 79 patients and they were completely or partially relieved in 63, or in 80 per cent.

The most frequent gynecological complaints associated with ureteral stricture are dysmenorrhea, "falling of the womb," ovarian neuralgia, and dyspareunia.

Gastrointestinal symptoms are among the most frequent and most distressing complaints of the ureteral stricture victim. A table showed the incidence of such symptoms as indigestion, anorexia, nausea, gas, diarrhea, rectal pain or pressure, and mucous colitis, and the percentage of relief obtained by the ureteral treatments.

Headache was a symptom in 54 instances and this was totally or partially relieved in 38 patients, a percentage of 70.

Pain in the hip was a complaint in 61, and pain down the leg in 51 instances, these localizations being duplicated in many patients. Fifty-five of these patients were totally or partially relieved.

The final item in the questionnaire, requesting that the patient classify herself under one of four headings, yielded the following result: (a) cured, 29, (b) much improved, 50, (c) improved, 15, (d) not improved, 6.

DISCUSSION

DR. JOHN G. CLARK, PHILADELPHIA, PA.—It is with especial satisfaction that I have heard Dr. Hunner's review of his results in 100 ureteral stricture cases. Dr. Hunner speaks of the fact that his failure up to date in giving such a resume has made him a target for criticism. As one of his friends, I confess that I have been one of those obstinate spirits who possess the Missourian spirit, "show me." A stricture in any other channel is a definite entity and possesses such diagnostic symptoms as to leave little question as to its presence. Looking back to one's internship days, we recall the spasmodic or well nigh impermeable stricture which resisted all attempts to pass a catheter, and finally gave way only on passage of a filiform bougie. All grades of these narrowed channels have come under our observation since, but the difficulty was always in getting beyond the stricture by frontal attack. Therefore, it is so difficult to synchronize these observations with Dr. Hunner's assertion that a wax-tipped bougie may pass all right but is caught in retrogression. I have been prejudiced not against but in favor of Dr. Hunner's work, for he has carried into it such enthusiasm and indefatigable energy and is so desirous for us to see the light that I am really anxious to be con-

verted. My associate, Dr. Floyd E. Keene, who has full charge of this work in my department, has approached the problem in this same spirit, for we cannot help but feel there is something decidedly of value in it. Possibly were Dr. Hunner to compromise in some other term than stricture we might agree more readily. We all are in accord with his assertion that daily all over the country patients are having all sorts of pelvic and abdominal operations for symptoms such as he ascribes to this form of stricture, with of course no relief whatever. Therefore, to define this condition and to devise a plan of treatment for relief is indeed a service to womankind. In this instance, however, one wonders whether the remedy is not more painful than the disease. Could such a plan be carried out successfully in one or at most a few treatments it would be worth the effort, but so many of these women have already become neurotic, and I fear that those who undergo this plan unsuccessfully will be plunged into the hopeless mire. This type requires the attitude of the neurological surgeon who must put many patients through severe ordeals to garner a relatively small number of final cures.

One cannot, however, discuss this subject lightly, for I feel that back of this work there is a very definite pathologic entity, which in a certain number of cases is finally relieved by his plan of treatment. Every one of us who deals with cystoscopic cases should be very alert, and when possible follow Dr. Hunner's advice in these obscure cases, whether we call them strictures or something else. I feel personally grateful to Dr. Hunner for this report of his cases, for he has put his cards upon the table, and while many of us may not be in full accord with him as to his interpretation of a stricture, we can at least assure him that we have not cleared up as many of these hitherto painful lesions as he has recorded today.

Will Dr. Hunner please mention how often he has been able to demonstrate by pyelography a stricture of the ureter?

DR. GUY L. HUNNER, BALTIMORE, MD.—My paper deals with those cases operated upon since we ceased our ureteral treatment, and some were operated upon during the course of ureteral treatments. Yes, I have many such pictures.

DR. HIRAM N. VINEBERG, NEW YORK.—I should like to ask whether it is Dr. Hunner's experience that most of these cases of stricture occur on the right side? Obscure pain in the right side of the abdomen is very frequently met with in women. Often the appendix is taken out and is found to be normal. Some small cysts of the ovary are excised or perhaps the entire ovary is removed, but the patient continues to complain of the pain she had prior to operation. If stricture of the ureter is a cause of obscure side pain in women, then it would appear to me there should be a marked preponderance of stricture of the right ureter.

DR. CURTIS F. BURNAM, BALTIMORE.—I think Dr. Clark is wrong in not being able to conceive of stricture where there is not a stoppage of the entire ureteral cavity. You often get a big stricture in the rectum with inflammatory infiltration all around, which destroys the musculature of the bowel, or of the esophagus where there is great difficulty in swallowing, not so much with fluid as with solid things. The pelvis of the kidney normally does vary from 1 c.c. capacity probably up to 20 c.c., so it would seem quite certain that strictures which were really periureteral inflammations would permit the catheter to go through and would cause pain and yet not lead to hydronephrosis.

I have personally seen a number of cases primarily which I have sent to Dr. Hunner for treatment and they have apparently gotten entirely well.

DR. DOUGAL BISSELL, New York, discussed the **Surgical Treatment of Renal Papillomata and Ureteral Implants in the Female,** and presented a case report.

A young woman, thirty-one years of age, who had previously enjoyed perfect health, developed a profuse hematuria lasting several days. Urological examination showed the right kidney to be the probable source of disease,—nephrectomy with partial ureterectomy was performed and the pelvis of the kidney was found filled with papillomata crowded into the upper ureter but not growing from the ureteral surface. The vesical orifice of the ureter showed no evidence of papillomatous involvement. Eight months after nephrectomy, hematuria again occurred,—examination then showed a papillomatous involvement of the right vesical orifice. The entire remaining portion of the ureter was now removed transperitoneally and transvesically by a new technic the advantages of which were: directness of approach,—opportunity afforded to contend with pelvic complications,—ample vision and room in which to manipulate with the exactness not afforded by the retroperitoneal approach.

The case was reported chiefly with the object of emphasizing the important relationship between a primary renal pathology of a papillomatous character and subsequent similar developments along the urinary tract and that when there exist primary renal papillomata with no evidence of ureteral involvement, these questions arise: Should nephrectomy with partial ureterectomy be done and evidence of ureteral involvement awaited before ureterectomy is completed or should nephrectomy be done followed by the removal of the remaining portion of the ureter at the earliest possible date; or, should nephroureterectomy be done immediately?

The study would seem to show that manipulation of the kidney at time of operation tends to dislodge particles of the papillomata which may be included in the ureteral tie and become implanted when this organ is severed and partly removed.

It is probable therefore that implants occur from above downwards and never from below upwards unless by continuity, therefore the urinary tract below the primary growth is peculiarly subject to this form of metastasis. When renal papillomata occur the ureter of the affected side seems more susceptible to secondary involvement than does the bladder, and is usually affected prior to it. Implants may occur anywhere along the ureter but are more liable to occur where there is a retarded flow, as at the vesical orifice, or at points of injury, as when the ureter is severed and tied on partial removal. We are not justified in concluding when nephrectomy is contemplated for renal papillomata, that the ureter is in its entirety normal because its vesical orifice seems not involved. As the ureter is susceptible to implants from the moment the primary growth above begins to throw off particles of itself, it should be considered a harbinger of danger, and as the ureter, under these circumstances, is a probable pathological entity it is advisable to remove it *in toto*. If the ureter is not completely removed at the time of nephrectomy, its remaining portion should be removed as soon as the patient's condition permits. The best method of removing completely the remaining portion of the ureter is by the combined transperitoneal and transvesical route.

DISCUSSION

DR. J. WESLEY BOVEE, WASHINGTON, D. C.—This is a new departure in surgery of the lower end of the ureter and certainly not without its merits. While I have never attacked the ureteral orifice by this route, yet I can see that it gives a clear field of vision for carrying out the work. Dr. Bissell realizes with us, I

think, that had he made his dissection broader at the first operation, the second one would have perhaps been avoided. But that is an after thought. It seems to me, however, that to cross the peritoneal cavity to deal with a disease that is considered malignant in the kidney is an additional and unnecessary danger, that such procedure should be done extraperitoneally, and I think in this case an early operation done extraperitoneally, removing the ureter as well as the kidney, would have been completely successful.

In 1909 I read a paper, which was published in the Journal of the American Medical Association, section on Obstetrics and Gynecology, describing an operation I devised, the technic of which was something as follows: Splitting the anterior vaginal wall over the site of the ureter. The ureter was separated, the whole of it removed from the bladder, or it was severed at the outer surface of the wall of the bladder, whichever seemed feasible. Then it was easy to free the ureter through the broad ligament, which is the only part at which it is notably fixed throughout its course, the artery behind the vein being easily lifted up. By making an incision, a transverse lateral abdominal incision, (Korrig's) about 1½ inches below the last rib, not entering the peritoneum, the kidney was easily reached, the artery severed, and a finger dissection easily separated the rest of the ureter which allowed pulling up the whole specimen through the abdominal opening, which was then closed either with or without drainage. In some cases I pushed a piece of gauze down through the pelvis to that portion of the tract from which the ureter had been removed, bringing it out through the vagina; in others I closed without drainage, and in no case was there drainage through the abdominal incision.

With this procedure I think one can remove a large amount of the bladder wall that had been previously demonstrated by the cystoscope to be involved; and if that did not suffice I am now conjecturing that incision through the vaginal septum would give us a view of the diseased area and permit resection of that portion of its membrane. I have not done that, I am only suggesting it. We know that we do expose portions of the ureteral orifice and the bladder oftentimes in that manner, and we sometimes see the ureteral orifice through vesicovaginal fistula openings. If the case is essentially malignant, one would have to be more careful of resections. I think in all malignant diseases of the kidney the ureter should be removed, but if there is much involvement of the bladder it is probable that a suprapubic incision would have to be made which can be made extraperitoneally and resection of the bladder done.

DR. JOSEPH B. DE LEE, CHICAGO.—Just a few words about the etiology of the so-called strictures in Dr. Hunner's series of cases. At autopsy it is not uncommon to find smaller or larger hemorrhages in the broad ligament around the ureter, especially near the bladder, in a woman who has died a few days after delivery. They are particularly common after forceps deliveries or very difficult spontaneous deliveries, and I would judge after the modern pituitrin deliveries.

Women after delivery often complain of backache and frequent urination. I have often thought that these symptoms were due to dislocation of the ureter and partial obstruction due to kinking, if not due to fibrous thickening of the base of the broad ligament.

DR. WILLIAM C. DANFORTH, EVANSTON, ILL.—Tumors such as Dr. Bissell has described occur more often in the practice of the urologist. I have seen two, in both of which we were fortunate enough to get autopsies. The first was treated by lumbar nephrectomy and subsequently by radium treatment of the secondary tumors of the bladder. The second case was too far advanced to do anything

more than a very rapid abdominal exploration. In both of these cases there were multiple tumors in the bladder. On the basis of the operative experience and the autopsy findings in both of these cases it seemed to me that the procedure of choice would be nephrectomy with complete removal of the ureter, which should preferably be done transperitoneally, provided the kidneys were not infected.

This leads to the question of treatment of the multiple tumors in the bladder. I would like to suggest in that connection, as a substitute for the rather radical surgical dissection, the application of a procedure which our urological friends are using,—electrocoagulation, which has been giving some very favorable results and which in some of these advanced cases of bladder tumors in connection with growths in the kidney, might be found very valuable.

DR. HUNNER.—It would seem from the report of the last speaker on Dr. Bissell's report, that it is not rare to have implants take place down the ureter, and if this is so, as is shown by repeated reports of the fact, we should certainly always do a nephro-ureterectomy. I am decidedly in favor of doing ureterectomies, even the secondary variety which Dr. Bissell has spoken of, extraperitoneally. There is no trouble after you have pulled up the ureter in entering the bladder, you don't have to dissect the whole bladder wall to get a good wide opening.

Dr. Clark I think has a great many others feeling as he does, that I have painted almost too optimistic a picture of the results we get by dilating the ureteral stricture, and I think they have in mind when they think of stricture, a stricture in the male urethra. There is a vast difference in the two conditions, the male urethra having the large corpora around the urethral tube favoring a tremendous mass of scar tissue, while on the other hand there is practically nothing but reticular tissue around the female ureter, and it seems logical that after treatment it would at least remain well dilated, or dilated enough for good drainage, far more readily than in the case of the male urethra.

Not much can be said for this work in extenuation for the amount of pain caused. The pain is not the fault of the use of the waxed bulb as I use it for dilating strictures. You get the same pain after the first treatment if you pass a plain catheter. The patient has pain because she has a stricture and anything that traumatizes it gives a little extra edema and pain results. I am running through 100 cases now, passing a plain catheter with the first treatment, and am getting the same proportion of complaints as in passing the small bulb.

The point raised as to many of these patients having an underlying neurosis is a very good one. Many of them I do refer to the psychiatrist and neurologist in the early part of the treatment, but it is surprising how many of them who look hopelessly neurasthenic, in the long run gain weight, get good appetites, good digestion and become able to take hold of life like normal people. It is perfectly surprising how some of these wrecks from past multiple operations make splendid recoveries.

To Dr. Brettauer I would say, yes I use the pyelograms daily. I have some hundreds of these pictures of strictures. I spoke last night about the misinterpretation of these plates. The x-ray man fails to see the little area down in the lower portion of the ureter where the ureter begins to dilate slightly.

In reply to Dr. Vineberg's question, these strictures are practically all bilateral. The majority of them have more trouble on the right side, probably because of the frequency with which they have an associated appendicitis. The appendix inflammation may spread across the peritoneum and start pain in the stricture, whereas the left side would not be so readily affected.

Dr. Norris asks about postmortem findings. We are working on the subject of the pathology of stricture now. I have had to do a certain number of extraperitoneal exposures and it has given me abundant opportunity to study the thickening in the ureteral wall, which is sometimes so thick that you think there must be a stone.

DR. JOHN G. CLARK.—What are the results in the retrograde work?

DR. HUNNER.—They are just the same as they are with the bladder route. You get a wider dilatation through the retrograde route while the patient is under anesthesia, but there is a tendency to subsequent contraction. This can later be treated through the bladder, but in one case I had to do the retrograde dilatation the second time before I could finish the work by the bladder route.

DR. BISSELL (closing).—Each man works best according to his experience and vision. Genitourinary and general surgeons do not operate on the pelvic organs of the female to the extent that gynecologists do, therefore they are not as familiar with pelvic pathology in the female. This familiarity with the intraabdominal work in the female should make the gynecologist the more appreciative of the directness of this route and the opportunity afforded him by it to cope advantageously with such pelvic complications as commonly are encountered in the genital organs of the female. Drs. Kelly and Bovee have on several occasions pursued the vaginal route in removing the terminal or vesical portion of the ureter but this route as demonstrated by them offered certain objections which are insurmountable. The pathology in this case as determined by Broder is a renal papillomata, malignant, group 2. In that the surgical work was done with seeming completeness and that the group in which the case falls is No. 2, we should feel encouraged in regard to prognosis. The patient has been receiving x-ray treatment since the last operation and all examinations so far are satisfactory.

OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF FEBRUARY 14, 1924

THE PRESIDENT, DR. EDMUND B. PIPER, IN THE CHAIR

Symposium on Rupture of the Uterus

DR. EDMUND B. PIPER reported **Two Cases of Ruptured Uterus.**

1. Mrs. M. P. Admitted, Aug. 13, 1919. Two previous children. Confinement expected, Aug. 12, 1919. Family medical history negative. No miscarriages. First child, forceps delivery; second child, normal. Present labor long drawn out, patient had been given pituitrin, the amount of the dosage questionable. Upon admission with undelivered child she gave all the classical symptoms of a ruptured uterus. She was delivered by version before I saw her. Following delivery, examination showed large rent in anterior lower uterine segment. At operation the abdominal cavity was full of blood and blood clots. Anterior wall of the uterus was torn completely across leaving hardly an inch of cervix. The partial traumatic hysterectomy was completed and the stump peritonealized as well as possible. As the abdominal cavity had been contaminated from below, the patient was drained. Following operation, after which she was badly shocked, she made an uneventful recovery.

2. Mrs. A. P. Admitted Dec. 22, 1923. Age forty-three. Eight previous children. Previous labors all difficult. Patient had been in labor actively for over

twenty-four hours. Under anesthesia, delivery had been attempted, with failure, version was then tried unsuccessfully. Upon admittance to the hospital patient was semiconscious from ether and markedly shocked. Abdominal examination gave the appearance of the fetus very close to the skin. Version was completed with great difficulty as the fetal body had apparently protruded through a rent in the anterior uterine wall.

Operation: Following the extraction of the dead fetus abdominal section and hysterectomy was performed with no drainage. She was treated for severe shock, after which she made a surprisingly uneventful recovery.

DR. CHARLES S. BARNES reported two cases.

1. Mrs. E. P., Polish, twenty-seven years of age, of good family and personal history. A history of two pregnancies, spontaneous labors, two healthy children of five and three years respectively. Seen by the speaker, in her home, in consultation, March 14, 1923. A history of amenorrhea, the last menstruation occurring early in January, 1923. Menstruation habitually regular. No other history obtainable except that of two or three days of bleeding from the genital tract, indefinite pain in the lower abdomen and pelvis, and weakness.

Great pallor was evident, accelerated breathing, a rapid thready pulse not perceptible at the wrist, a subnormal temperature. Pelvic examination showed uterine signs of a two month's pregnancy, moderate tenderness and a visible moderate genital hemorrhage. The lower abdomen was somewhat rigid and tender and dull on percussion. A diagnosis of intraperitoneal hemorrhage was made, probably due to a ruptured extrauterine pregnancy. The patient was promptly transferred to a hospital and abdominal section done. The pelvis and considerable of the lower abdomen were filled with blood. The appendages were intact but a rupture or rent in the anterior wall of the uterus presented itself, so ragged and extensive as to necessitate supravaginal hysterectomy. The patient later admitted that the wound was self-inflicted. Deserted by her husband, and desperate in the thought of a third child to support, believing herself pregnant (which was true) she attempted self-induction of abortion by thrusting an ordinary hard rubber douche nozzle into the uterus. Evidently the nozzle, entering the cervical canal in the manipulation, had then been pushed through the anterior wall of the cervix into the peritoneal cavity, partially separating the bladder from its uterine attachment. One large piece of gauze was packed into the pelvis through the abdominal wound, to guard against hemorrhage, and, on its removal, to provide for the exit of probable infection.

The reaction of the patient was good, but her recovery, finally complete, was prolonged, due to local infection.

2. Mrs. A. B., Irish, thirty-two years old, in good health. On September 22, 1922, the patient was first admitted to the Philadelphia General Hospital six and a half months pregnant. Pains were present suggestive of threatened premature labor, but the predominant symptom was that of vomiting. After four days' observation and treatment the vomitus became dark green, pain was complained of in the right inguinal region and pain and tenderness under the right costal margin. The attending chief, deeming abdominal section imperative, found a cholelithiasis for which he did a cholecystotomy providing drainage which was continued for several weeks following. A six and a half months fetus was delivered by cesarean section. Needless to say the above treatment was at the hands of a competent man. Eight months subsequent to the above outlined treatment, May 29, 1923, the patient, admitted again to the Philadelphia General Hospital, came under the writer's care. She gave a history, borne out by physical findings, of a five and a half

months pregnancy, the seventh. The first five had terminated spontaneously at full time, the sixth as above cited by hysterotomy.

On admission, she had a normal temperature, normal blood pressure, a pulse of approximately 100, a hemoglobin of 60 per cent. The patient gave a history of having had for several days, beginning a week previous to admission, "smothering spells" with vague occasional slight abdominal pain; of having been seized two days before admission with tenesmus of the bowel and bladder, accompanied, while on the toilet, with acute pain in the pubic region. When admitted, very moderate irregular pains in the lower abdomen were complained of, and there was slight tenderness in this area. An incisional hernia appeared above the umbilicus.

No evidence of fetal life. Dullness was observed in the flanks. The patient at no time gave clear evidence of a serious condition, but during a few hours observation, the abdominal pain increased and the pulse became slightly accelerated. Abdominal section was done with a preoperative diagnosis of probable rupture of the uterus, possibly intestinal obstruction.

After removal of considerable free blood from the preitoneal cavity the uterus appeared with a longitudinal rupture of its anterior wall, four inches in length, clean cut, evidently a separation at the line of incision at the time of cesarean section. The intact amniotic sac inclosing the fetus lay free in the peritoneal cavity.

The previous operator informed me that he is accustomed to use several layers of catgut in closing the uterine wound. After removing thin strips of tissue, to freshen the apposing uterine walls, I closed the wound, as is my custom, with three layers of chromic catgut.

It seems that no infection was present following the primary operation to interfere with firm union of the wound. The most rational predisposing cause of rupture is doubtless the early occurrence of pregnancy, conception taking place two and a half months following hysterotomy.

DR. NORRIS W. VAUX reported three cases.

1. Mrs. T. B., white, age forty-one. Admitted to Chestnut Hill Hospital, September 22, 1923. Diagnosis on admission: Pregnancy, ruptured membranes, not in labor. Para viii. Seven previous labors, one set of twins, seven children living and well. Patient had been attending the Prenatal Clinic, normal pregnancy. Patient admitted eight days after estimated probable date of confinement with early rupture of membranes. Labor began six hours after rupture of membranes. Fetal heart sounds heard on admission with difficulty. First rectal examination: Heavy, thick gristly cicatrical cervix, dilatation three cm. Labor progressed until midnight (slowly) ten hours after rupture of membranes, pains increased in severity, regular three minutes. First vaginal examination: Cervix fully dilated, head engaged. Diagnosis: L. O. P., large firm head of overdue baby. Head did not engage well, one attempt at forceps delivery under ether was unsuccessful. Uterus was contracted firmly about child, head in occiput posterior position, easily pushed out of its engagement and difficult version performed. Large aftercoming head delivered by forceps. Baby stillborn. Weight 9.5 ounces.

Patient's condition excellent, some hemorrhage following delivery, uterus contracted well, moderate hemorrhage continued with firmly contracted uterus. Pulse rose to 120 ten minutes after delivery, it was noticed that the cord was retracting quite rapidly into vaginal orifice. Condition of patient showed early symptoms of shock. Twenty minutes after delivery pulse rose to 140, placenta removed manually from left side of abdominal cavity through a large circular tear above vaginal vault on left side, hemorrhage not excessive. Patient quite conscious, moderate shock, was treated for further shock and vagina packed. Forty-five minutes after delivery condition had improved, laporotomy was performed, easy rapid hysterectomy

followed. Patient left table in good condition, pulse 140 and of good quality, respirations 26, temperature 97.4, reacted well, no further hemorrhage. Pulse gradually rose to 160 at the end of twelve hours, no external bleeding or symptoms of hemorrhage.

Death followed thirty-nine hours after hysterectomy without further rally after transfusion, etc.; some blood clots and free blood in peritoneal cavity at time of operation.

2. Mrs. S., white, age twenty. Admitted to Lying-In Charity Hospital on October 22, 1923. Diagnosis: Pregnancy. Primipara, in labor. Small, rather pale young woman with a definite history of neisserian infection two years previously, followed by an illness lasting three weeks, at which time she had abdominal pain and tenderness of right and left sides, and pain in lower abdomen with difficult urination, purulent discharge, distention, with fever and vomiting. Slow convalescence about three weeks at home. No return of abdominal pain or distress, periods to time of pregnancy normal, pelvis small but normal, labor, twenty-six hours of normal first and second stage. Baby weighed 6 pounds, 5 ounces.

Two vaginal examinations made, placenta expressed spontaneously, temperature 97° after delivery, no postpartum hemorrhage, pulse 96, respiration 18. After two days of normal convalescence temperature rose to 102°, some foul, odorous lochia with pain in right side and definitely tender and enlarged uterus, marked on right side. On fifth day temperature reached 104, pulse 120, some vomiting and acutely tender over right side of uterus and pelvis, lochia distinctly purulent. On seventh day temperature went to 103, moderate sized firm mass felt at right side of uterus in pelvis, lochia much improved in character, patient's general condition about same, on tenth day mass had definitely increased rapidly in size, very tender and extended up right side on abdomen to level of umbilicus.

Vaginal examination showed no other areas of inflammation of pelvic masses other than sensitive uterus and mass on the right side connected with uterus, nonfluctuating. Laporotomy was performed on tenth day, large mass of omentum adherent to uterus, when gently removed, about six ounces of foul-smelling blood and pussy material evacuated. There was a distinct rupture or rent in right lateral anterior wall of uterus about three inches in length. Hysterectomy and uninterrupted convalescence.

3. Mrs. F. M., white, age twenty-one. Admitted to Bryn Mawr Hospital Ward on Jan. 16, 1924. Diagnosis: Ruptured Uterus. Primipara. History given by attending physician outside hospital that patient had had forty-six hours of labor with no advancement. After completion of the first stage he advised removal to hospital, this was refused. Forceps applied in home under poor and unsanitary surroundings. After several attempts child was delivered stillborn. Perineal lacerations. Afterbirth did not deliver and physician made attempt to remove it manually at which time he found the examining hand went well into the abdominal cavity through a rent in the left side of the vaginal vault. Patient was then sent to hospital in an ambulance with placenta retained.

On admission: Pulse 110, temperature 98°, respirations 24, moderate bleeding, symptoms of shock not marked, no attempt had been made to suture perineal laceration. Placenta removed manually. Diagnosis confirmed, vagina packed and patient treated for shock, condition became critical but responded to treatment. Twelve hours after admission condition of patient justified further procedure. Patient was prepared for section, etherized and packing removed. Thorough examination of birth canal made, revealed the following: Laceration of birth canal of severe magnitude, cervix was lacerated in many places but a large left lateral tear extended up into the abdominal cavity.

Immediate hysterectomy. The laceration extended on left side posterior to the broad ligament upward, about 3½ inches. Pelvis contained blood clots and some

free blood. Vaginal drainage placed. Patient reacted well from operation, convalescence has been quite normal with exception of inability to control flow of urine, patient was incontinent. At present time patient is recovering the bladder function. General condition is such that she could be discharged except for occasional incontinance of urine.

DR. CHARLES C. NORRIS reported three cases.

CASE 1. Illadvised forceps operation resulting in rupture of umbilical cord; deep tear in the myometrium prior to admission to the Philadelphia General Hospital. Easy forceps delivery, abscess formation, rupture of abscess on the 13th day and death from general peritonitis on the fifteenth day. Autopsy.

Mrs. E. Mac T., para xii; pains started at 11 P. M., forceps were applied one hour later; between then and her admission to the hospital at 6 A. M. the next morning, forceps were unsuccessfully applied three additional times. When seen by me two hours after admission, her temperature was 98, pulse 120 and respiration 40; general condition of the patient was worse than these figures would indicate. The pulse was of poor quality, the skin leaky and no fetal heart sounds could be heard. Examination showed a wide vaginal outlet and an L. O. A. position. An easy midforceps operation was performed and the placenta was manually extracted. A deep tear was found involving the right side of the uterus low down and extending outwards to, or nearly to, the peritoneum. No communication with the peritoneal cavity could be demonstrated. The infant weighed nine pounds, was dead, and the cord was torn off flush with the umbilicus, evidently the result of the previous attempts at delivery. Subsequent to delivery, the temperature showed evidence of mild pelvic peritonitis, but the patient seemed to be doing moderately well. This condition continued until the thirteenth day, when after moving in bed, she complained of sudden pain in lower right abdomen, followed by evidence of shock. General peritonitis developed and death occurred on the sixteenth day. Autopsy confirmed the clinical findings.

CASE 2. Mrs. M. G., para iii, in labor twenty-four hours and was finally delivered after considerable difficulty with forceps by family physician. The patient showed marked evidence of shock and on my examination two or three hours later, a large tear in posterior uterine wall which easily admitted the hand into the peritoneal cavity, was demonstrated. This patient was transported five miles in a Ford car to a county hospital where supravaginal hysterectomy and conservation of tubes and ovaries was performed, normal convalescence. The tear in this case was about 10 cm. in length and ran diagonally downwards through the posterior uterine wall. This case illustrates the amount of trauma to which pregnant women may be subjected and still survive. After her arrival at the hospital, her general condition was moderately good.

CASE 3. J. R. A cesarean section had been performed upon the patient two years previously at the Philadelphia General Hospital. She subsequently became pregnant and during labor, the uterus ruptured. The patient was brought to the hospital with the clinical signs of rupture and immediate supravaginal hysterectomy with conservation of tubes and ovaries was performed. This was followed by a normal convalescence. The infant weighed 7 ½ pounds and was found with the placenta lying among the coils of the intestines. The membranes were ruptured. The scar from the previous cesarean section could be demonstrated as a thin razor-edged cicatrix on the anterior uterine wall. There was absolutely no thinning of the myometrium, and to all intents and purposes, the scar appeared to be an excellent one. The tear started at the upper limits of the cicatrix, followed this downward for about 1 cm., diverged to the right and paralleled the previous incision, leaving about 3 or 4 mm. of apparently normal muscle tissue between it and the old scar. His-

tologic examination in this specimen confirmed the above findings. There was no ingrowth of endometrium into the cicatrix as has sometimes been observed. This case is of interest because it demonstrates that even with good healing of the uterine wound, rupture may occur. Unfortunately we have been unable to ascertain what was the position of the child or whether pituitrin had been administered. The pelvic measurements were normal.

I have been able to follow four patients on whom I performed the high cesarean section and who subsequently became pregnant. The first of these was admitted to the Philadelphia General Hospital at about 6½ or 7 months of pregnancy, suffering from an acute cholecystitis. The usual palliative treatment was instituted for a few days but the gall bladder condition rapidly became worse, marked jaundice developed together with a high fever and all the indications of purulent cholecystitis. About this time, the patient developed symptoms of beginning premature labor, the cervix was thick and firmly contracted and delivery from below would have been difficult. Cholecystectomy and the removal of a gallstone from the common duct was performed, the gall bladder contained pus. On account of the condition of the patient, it seemed unwise to submit her to the added strain incident to premature labor, and for this reason, a cesarean section was performed prior to the gall bladder operation. Convalescence was complicated for the first week by a moderate elevation of temperature, and from that point, was normal. This patient subsequently became pregnant and the uterus ruptured. This is the case which has been reported tonight by Dr. Barnes. Whether or not there was good healing of the uterine wound, is impossible to determine, as the fever present during the first week may have been due to the gall bladder wound.

In addition, I have two cases of central placenta previa, upon which cesarean section was performed; one of these patients was delivered in Chicago last fall and wrote me that she had had an easy, spontaneous labor at term. The other I have delivered twice since her cesarean section, both times, however, in the hospital. Both labors were uncomplicated.

One other case is strongly impressed upon my mind, as it was the first cesarean section which I had ever performed, a rather elderly primipara with a large and firmly contracted cervix; she had a premature separation of placenta. A dead baby was diagnosed. Cesarean section was performed as a life-saving measure and was followed by normal convalescence. I subsequently delivered this patient in the maternity hospital and convalescence was normal.

DR. BARTON COOKE HIRST, then read a paper on the **Causation and Treatment of Rupture of the Uterus.** (For original paper see page 757.)

DISCUSSION

DR. EDWARD R. DAVIS.—So far as the recovery of the mother is concerned, the most favorable rupture of the uterus is through the fundus with complete escape of the child into the abdominal cavity. The reason for this is in the fact that if such an accident occurs and the alkaline plug of mucus in the cervix remains intact, it is possible for the woman to escape infection, and the chances of recovery are vastly better than if there is rupture through the lower segment. In a recent case a woman fell from a passenger elevator, breaking two ribs, injuring her breasts severely. She continued to do her own house work for eleven days after rupture of the uterus. Complete recovery resulted after operation. In that case the blood in the abdominal cavity, not large in quantity, was cultured and was sterile, so was the ruptured uterus and there was no evidence whatever of infection.

The most dangerous uterine ruptures are in the lower segment. Hemorrhage must occur because there is no adequate uterine retraction. Rupture of the uterus at

the placental site, is due to local autolysis and weakening of the uterine muscle. That brings up the question of spontaneous rupture: fatty degeneration of the uterine muscle in multiparae, insidious and accompanying partial separation of the placenta is not infrequent. In these cases one will find on the posterior wall a longitudinal rent several inches in length where the uterus has ruptured through its peritoneal covering.

To illustrate how difficult it may be to ascertain the precise cause of uterine rupture, in six instances there will be one in which no adequate cause can be found. Cases of especial interest are those of degeneration of the uterine muscle and especially those of necrobiosis, autolysis, and of complete rupture through the fundus with the entire contents of the uterus in the abdominal cavity, followed by recovery after prompt operation.

DR. RICHARD C. NORRIS.—The types Dr. Davis alluded to are of great interest, but they are not the kind of cases hurried into the hospital *in extremis*. As I look back on my experience spontaneous ruptures are very rare indeed. Hydrocephalus, neglected shoulder, a few such cases I can recall, but almost always it has been bad obstetrics. The symptoms of shock and hemorrhage are often misleading; if a woman is being operated on and under anesthesia the operator does not have these classical symptoms to go by. So I would like to stress that one point that the important pathologic changes in the uterus Dr. Davis has referred to have a bearing on the ruptured cesarean and have a bearing on so-called spontaneous rupture of the uterus. Spontaneous ruptures are rare, but they are becoming more frequent since cesarean section is being more frequently done. Danger of rupture is very much less operating on the lower uterine segment and is a distinct argument in its favor. The problem of rupture following cesarean: What are we to do for these patients? I am afraid to take care of a woman who has once had a high cesarean unless she is in a hospital, unless she is pretty close at hand in the last few weeks of pregnancy, on account of the insidious progress of these cases and apparent freedom of shock. The early incomplete ruptures were treated by tampons, but the man who will bungle, do version or forceps, is not capable of doing tampon treatment in a skilled way. Any case of ruptured uterus I was going to operate on I would first transfuse. I believe transfusion would have saved loss in the past and it is worth taking the chance of transference of the patient to the hospital. There are, of course, exceptional cases where tampon treatment might be applied.

DR. WM. R. NICHOLSON.—I have seen quite a number of cases of rupture of the uterus under the various headings mentioned by Dr. Hirst, but to my mind the most interesting part of the discussion relates to the rupture of a scar of a preexisting cesarean section. I happen to have had three of these cases, one fatal and two resulting in recovery. The fatal case was taken to one of the large hospitals in town but was refused admission by the interne on duty since this hospital did not admit maternity cases and his examination did not reveal to him that this woman was anything other than a beginning labor. Two cases ruptured, one in the succeeding pregnancy, while the other had had a vaginal delivery between her cesarean and the pregnancy during which I saw her. Both these cases had been operated upon by competent men.

The point to call attention to in each of these cases is that the rupture occurred apparently while they were in the hospital, and without symptoms which were at all diagnostic. When they were seen by me each was having slight pain, not at all characteristic of labor and without pulse or temperature rise. In neither case was the cervix obliterated and in neither case was the membrane ruptured. Operation in both instances disclosed intact membranes, the fetal sac with the placenta being free in the abdominal cavity, while the ruptured uterus was firmly contracted

in the pelvis. Both these cases recovered with a perfectly normal postoperative history. While the microscopic study was not absolutely conclusive, in either instance, I believe that both cases lacerated through the old cesarean scar.

As far as the etiology of rupture is concerned, my personal belief is that to a large degree it depends upon the site of placental attachment. If a woman who has had a cesarean has an implantation of the placenta in her next pregnancy, over the old scar, the syncytial activity will digest the scar tissue and will therefore result, in a large proportion of cases, in the type of rupture which I am describing. In other words, that rupture may occur, and probably will occur, before labor begins, and that the pain results simply from peritoneal foreign body irritation.

I do not believe that it makes the slightest difference how the uterus is repaired, as far as the probability of subsequent rupture is concerned. While I do not claim that it is necessary for a woman who has had one cesarean to always be delivered by a cesarean subsequently, I nevertheless feel that it is a very much safer procedure, and I also believe that if it were possible to obtain reliable statistics, that subsequent rupture would be found to occur in cesareanized women very much more frequently than any statistics have so far indicated.

DR. EDWARD A. SCHUMANN.—I can add two cases, one occurring after a condition not previously reported here. The first was a rupture by direct violence in a woman pregnant at almost term. She was carrying a chair downstairs when she fell, the leg of the chair passing through the vagina and into the abdominal cavity. The chair was extracted, the leg having been tightly wedged into the abdomen and the patient was rushed to the hospital where she died within half an hour after admission before any operative measures could be instituted. The second case was in a woman whom I had previously delivered with high forceps and in her second pregnancy she had been in labor several hours, when my associate, Keller, elected to do version. He told me as he attempted to turn the child the legs came down with difficulty. Suddenly the legs came down and there was a rent in the right side extending through the abdominal cavity. The patient was in profound collapse and he decided rather than perform immediate operation he would pack the rent and hope for reaction, with a second hysterectomy. However, the patient did so well that at the end of two weeks no one could possibly have detected the presence of a uterine rupture. The uterus had completely involuted, although the original rupture had extended to the fundus.

DR. GEORGE M. BOYD.—Meddlesome midwifery, also disregard for the time element in labor, is the cause of some of these disasters. We can reduce the number of cesarean sections in the doubtful cases by giving the labor test. Failing in this we can still resort to a low cesarean. The dictum, once a cesarean always a cesarean, if not adhered to, should be kept in mind because of rupture.

DR. JOHN A. McGLINN.—During twenty-five years of practice, I have never had nor have I ever seen, in all these years, a case of ruptured uterus. I have had cases of perforation of the uterus. Several years ago I read a paper before the American Gynecological Society on intraperitoneal cesarean section, and predicted that if the craze for intraperitoneal and low cervical section kept up that we would have many more cases of rupture following cesarean section. I based my contention on the fact that spontaneous rupture usually occurs in that part of the uterus where the incision is made for low cervical section. My contention has not been borne out by statistical returns but I still expect when more cases of low cervical section have been reported that we will find many more cases of rupture. I have had recently three cases of attempted version referred to me where it was necessary to do a craniotomy on the head in two cases and on the third a hysterectomy. These three uteri must be made of cast iron not to have ruptured.

DR. J. C. HIRST.—About a year ago we had a true spontaneous rupture of the uterus in the University Maternity. The baby was lying entirely free with the placenta in the abdominal cavity, having been extruded through the very top of the fundus. After hysterectomy the uterus was found to have undergone considerable hyaline degeneration in and around the ruptured area. The interesting feature about this case was that she had never had a labor pain nor a fall nor any possible cause for the rupture.

A different case followed this in the Philadelphia General Hospital where a multiparous patient after a long labor developed a rupture of the entire left side of the uterus resulting in the retention in the uterus only of a hydrocephalic head. The question of craniotomy arose here but we were sure of the injury and therefore performed a successful hysterectomy. Each of these women made a complete recovery.

DR. ALICE WELD TALLANT.—During the years I was at the Woman's Medical College, the only case I ever saw was from an outside physician, brought to the hospital, and version was done. We never knew when the uterus ruptured. It was an interesting point to know who had done it. Version was done rather early. There was some little bleeding and an assistant began to pack the uterus. I then found a small rupture. The patient had a hysterectomy done and made a good recovery. I mention this case as it might have been caused by packing too vigorously, or I may have ruptured uterus by version.

DR. NORRIS W. VAUX.—Statistics which I have been able to find in this college library seem to prove conclusively that the majority of ruptures, no matter how they occur, are in the lower uterine segment. The lower uterine segment apparently is the expansible portion of the uterus. The upper portion is the contractile portion. If the contractile portion is contracting against the lower expansile part it is rather natural to suppose the stretching area is more likely to split or rupture. The majority occur in the poor obstetrics we see occasionally practiced and I reported these cases in the hope that we would gain from discussion some result at betterment and some further criticism as to the judgment used in the time and method of operative interference. I believe that spontaneous rupture takes place and usually occurs in the uterus where some degeneration of the muscle wall exists, such as the perforation of the chorionic villi or where myomatic or inflammatory change has weakened the wall structure.

Department of Reviews and Abstracts

Conducted by Hugo Ehrenfest, M.D., Associate Editor

Selected Abstracts

Physiology and Pathology of Labor

Ludwig and Lenz: Labor Observed through an Abdominal Window. Zeitschrift für Geburtshülfe und Gynäkologie, 1923, lxxxvi, 589.

The authors report most interesting direct observations of the muscular activity of the rabbit's uterus through celluloid windows sewed into the abdominal wall, using a modification of the technic of Katsch and Borchers.

They find that the normal nonpregnant uterus shows an alternation of periods of rest and peristalsis; these periods are of considerable duration. The contractions travel like a peristaltic wave over the whole organ, through the whole length of the uterine horn, or gradually become lost after having travelled part way. In the course of the peristaltic waves, at various places stronger tonic ringlike constrictions appear which may be multiple. Coincident with tubelike peristaltic contractions a shortening of the uterus in its long diameter occurs. In addition to the peristaltic waves, which originate at the uterine horn and travel toward the cervix, there are also occasional antiperistaltic waves which travel in the opposite direction. Although the uterus during its contractions shows more or less motion in its relation to the other abdominal organs, definite pendulum motions such as are seen in the intestine, were not observed. The contracting part of the uterus always appears markedly anemic while the relaxed portion shows normal circulation. The two uterine horns function entirely independent of one another.

Observations on the pregnant uterus showed an almost entire absence of contractions, or only very small ones, scarcely noticeable, which could be observed only on short segments of the uterus, whereby the form of the uterus scarcely changed. Ring contractions never appeared definitely, and also the circulation in the contracting part showed little change from that which was resting. The whole organ had usually a deep blue color, and seemed to be absolutely passive in the abdominal cavity. The individual fetuses could be easily distinguished through the musculature and fetal movements were definitely visible.

In the earlier experiments, spontaneous labor was awaited but in the later ones, labor was induced by an injection of placental and pituitary extracts. Though neither of these are effective alone, it was found that labor could be induced in the rabbit at any period of pregnancy by a combination of the two. The course of labor was practically the same in all cases whether it was spontaneous or artificially induced. The writers describe in detail a typical labor induced three days after the introduction of the celluloid window in an animal two to three weeks pregnant. The uterus shows slight peristaltic and antiperistaltic movements, never affecting its whole length and the ring contractions are also entirely absent. Almost immediately following the injection of 0.5 c.c. of placental extract intravenously, there appear extremely strong peristaltic waves which traverse the whole

length of the organ and recur every three minutes. These begin in the upper portion of the uterus and move down as peristaltic waves, the ring contractions are less definite, the maximal contraction appears rather as a cylinder. There is only an insignificant decrease in length. At the point of maximum contraction, the almost 4 cm. wide uterus decreases to one-half cm. and this area becomes markedly anemic. After about 15 minutes, the peristalsis quiets down somewhat, 1 c.c. of placental extract now given intravenously markedly increases the strength and duration of the peristaltic waves. Extremely marked cylindrical contraction rings appear between the different fetuses to be followed by maximum relaxation. One half c.c. pituitrin given ten minutes later causes a tetanic contraction with cessation of all peristaltic waves, which gradually disappears after 40 minutes and is followed by the reappearance of waves at 3 to 5 minute intervals. The first fetus was born unobserved during the night. Throughout the entire following day, uterine activity was quite feeble, slight peristaltic waves appearing every 15 to 20 minutes. Renewed activity is brought about by the further injection of 1 c.c. of placental extract subcutaneously and 0.5 c.c. pituitrin intravenously. The latter is followed by an intense general contraction of the uterus. The lowest contraction ring between the two lowest fetuses seems almost to cut through the uterus and moves from above downward. The lowest segment is for a moment in an intense tetanic contraction and at this moment with a strong pressure of the abdominal muscles, the second fetus is born. The afterbirth follows a moment later, the uterus expelling it by a cylindroid tonic peristalsis from the lower contraction ring downward with the help of the abdominal muscles. The next lowest fetus is now pushed into the lower uterine segment and the process is repeated.

The other horn does not participate at all in this activity, it shows only a few slightly increased pregnancy contractions. The puerperal uterus shows marked rhythmic activity of the cylindroid-peristaltic type with the formation of multiple contraction grooves, which gradually decrease in activity. MARGARET SCHULZE.

Nürnberger: The Biology of the Isthmus Uteri. Zeitschrift für Geburtshülfe und Gynäkologie, 1922, lxxv, 1.

The isthmus uteri is an anatomically and functionally distinct segment of the uterus placed between the fundus and the cervix. It forms the upper third of what is usually considered the cervical canal, and its upper boundary is the anatomical internal os. Its lining mucosa resembles that of the uterine body and its lower boundary is at the point where this meets the typical cervical mucosa. This point can only be determined microscopically. The musculature of the isthmus is of looser texture and there is more connective tissue than in the myometrium, but not so much as in the cervix proper. The elastic tissue content is also midway between that of fundus and cervix.

In pregnancy and labor, the isthmus uteri forms the lower uterine segment. Pathologically the isthmus uteri may form the placental site in cases of placenta previa, and it forms the most frequent site of uterine rupture in cases of extreme dystocia. As a placental site, the isthmus uteri shows a definite functional insufficiency, due largely to the imperfect development of the decidua, particularly the glandular layer, which leads to pathologic adherence of the placenta. Postpartum hemorrhages are most often due to retention of adherent fragments, rather than atony from insufficiency of the musculature.

Researches of the author upon a considerable number of premenstrual and menstruating uteri, showed that in spite of the strong anatomic resemblances between the two structures, the mucosa of the isthmus uteri did not participate in the premenstrual congestion of the endometrium. Menstrual hemorrhage does occur from the isthmus, but instead of the loss of the whole functional layer as in the uterus,

only the surface epithelium with the portion of stroma lying directly beneath it is cast off. This lack of the premenstrual or pregravid changes in the isthmus uteri will explain largely its unsuitability as a nidation site for the ovum.

MARGARET SCHULZE.

Kosakai, Ziro: The Action of Combinations of Uterine Stimulants. Zeitschrift für Geburtshülfe und Gynäkologie, 1922, lxxxv, 364.

The author summarizes his conclusions as follows:

(1) Albumin-free and cholin-free placental extract causes uterine contractions. (2) The initial activity of placental extract as compared with other oxytocics is not particularly great. (3) The tonus of the uterus invariably decreases after the decline of the first action of the placental extract. Repetition of the injection increases the activity anew, in fact, the second result is usually greater than the first. (4) A certain time after the administration of placental extract, but particularly after repeated doses, there occur rhythmic equal contractions separated by regular intervals. These characteristic contractions are very similar to the physiologic contractile activity. (5) The latter is best obtained by the administration of a combination of placental and hypophyseal extracts. This combination invariably excites intensive characteristic contractions in the uterus *in situ* in any phase of sexual activity. The immediate as well as the subsequent contractions are much stronger, and the latter occur much more rapidly than after administration of placental extract alone. The puerperal or gravid uterus shows these contractions much sooner than the non-pregnant organ. Typical contractions of the isolated organ occur only in the pregnant uterus; in the nonpregnant uterus they are very small or even quite uncharacteristic. (6) Repeated administrations of combinations of placental and hypophyseal extract increase the excitability of the uterus. The contractions become much stronger and more lasting. (7) An animal which has been given hypophyseal extract reacts to placental extract with much stronger, repeated contractions than one which has been given placental extract alone, or one in which the pituitary extract is given following the placental. The decrease in tonus after the action of the placental extract wears off, is not so great if hypophyseal extract has previously been given. The reactions of the isolated uterus toward hypophyseal extract are very much greater after previous treatment with placental extract than after administration of hypophyseal extract alone or after placental extract following hypophyseal. Typically recurring characteristic contractions occur only in the pregnant or puerperal organ. (8) An isolated uterus previously sensitized by the combined action of placental and hypophyseal extract which has once shown the characteristic contraction may be again rapidly stimulated by placental extract, hypophysis, or secale alone. (9) An injection of adrenalin does not influence the onset of the characteristic contractions in rabbits or guinea pigs, but if contractions are already occurring, it seems to act more favorably. The adrenalin in action, like that of the other extracts mentioned above, is greater following the administration of other uterine stimulants.

MARGARET SCHULZE.

Mennet, J.: The Use, Action and Dangers of Pituitary Medication in Obstetrics. Schweizerische Medizinische Wochenschrift, 1923, liii, 549.

The various disasters reported in literature from the use of these preparations can be avoided by their intelligent use in each case. Violent pains last for about forty minutes after the intravenous, and an hour after intramuscular injections. Pituglandol does not cause the same type of severe or rapid reaction as pituitrin. The best opportunity for intramuscular or subcutaneous injections is presented in marginal placenta previa and in primary and secondary weakness of contractions

at the end of the first and during the second stage. Intravenous medication should be used only during the second stage. Other indications for the intramuscular and subcutaneous injections are: marginal placenta previa with ruptured membranes, central placenta previa after combined version, hydramnios after the rupture of the membranes, prolapse of the cord or small parts after they have been replaced, in contracted pelves where the head had become fixed with the use of the Walcher position. Contraindications are: extreme contractions of the pelvis, threatened rupture of the uterus, unfavorable positions, asphyxia of the child, poor dilatation of the cervix in first stage, absence of pains, general diseases of the patient such as arteriosclerosis and kidney diseases with abnormal blood pressure. The preparation is used in the third stage to hasten the delivery of the placenta. It is advised that midwives be not allowed to obtain or use the preparations.

A. C. WILLIAMSON.

Jacoby, P.: The Effect of Small Doses of Pituitrin. Acta Gynecologica Scandinavica, 1924, iii, 26.

It seems well established that the usual 0.5 cm. dose of pituitrin can well be replaced by one of 0.2 cm., since the effect is practically the same. Where the effect of the smaller dose is only fair or nil, a better result is not obtained with a larger dose. Very small doses of pituitrin have the same good effect in the first and second stages of labor. The injections can be repeated frequently. The position of the fetus and parity play no part in the effect of pituitrin, but the effect is less marked in older women. The results are good in primary and secondary inertia but are not very satisfactory in prolonged labors and in cases where there is elevation of temperature. Minimal doses of pituitrin in the author's experience were not dangerous to either mother or child. Because of this the author advocates the use of the drug early in labor and with frequent repetition.

J. P. GREENHILL.

Nystroem, B.: Compression of the Aorta in the Practice of Obstetrics. Finska Laekaresaellskapets, 1923, lxv, 679.

The writer describes all the methods of compression of aorta or uterine arteries for postpartum hemorrhages so far devised. In detail he gives results obtained by him in 15 cases with the Sehrt aorta clamp, which he slightly modified by placing, both on the branch lying on the back of the patient and that compressing anteriorly the aorta, an elastic cushion. (Illustrations are given in the text.) The clamp was applied either before or after expulsion of the placenta.

Experience so far had with the instrument permits the deduction that it is of great value, especially in home work when experienced assistance in handling a severe postpartum hemorrhage is not readily available, and even primitive asepsis hardly can be obtained.

Though applied for times varying between 3 and 16 minutes the Sehrt clamp in no instance caused the patient any noteworthy annoyance. Nevertheless the complete cutting off of all blood supply to the lower part of the body implies enough potential danger to make this method of treatment desirable only in cases where other simpler methods are not available or have failed. (Author's abstract.)

Zimmerman: The Control of Postpartum Hemorrhage by Clamping the Parametrium by Henkel's Method. Archiv für Gynäkologie, 1923, cxx, 160.

In the last 1600 deliveries at the Jena clinic, clamping of the parametrium to control postpartum hemorrhage was done in 17 cases, 6 being for placenta previa, 6 for hemorrhage due to uterine inertia and atony, 1 for carcinoma of the cervix,

2 for severe postabortal bleeding and 2 for atony following cesarean section. The clamps were left in place from 2-24 hours. The method is rapid, aseptic and certain, and is indicated whenever uterine bleeding cannot be controlled by drugs or external manipulation. RALPH A. REIS.

Hochenbichler, A.: The Entrance of the Head into the Pelvis in Primiparas and Multiparas. Monatsschrift für Geburtshülfe und Gynäkologie, 1922, lix, 250.

Under physiologic conditions, where there is no disproportion between the head and the pelvis, there is no essential resistance to the entry of the head into the pelvis. Some factors favor entry while others tend to hinder it. In the former class is the *vis a tergo* due to the contractions of the uterus and the abdominal wall. In the latter class are the lack of false pains during the last period of pregnancy and a diminished tonus of the uterine muscle due to previous labors and a relaxed abdominal wall. In this class also, and of more importance, is a high position of the uterus due to an increase in the amount of liquor amnii or other conditions. The overstretched lower uterine segment cannot accommodate itself to the narrow pelvic canal and therefore remains above the pelvic inlet.

Through the expulsion of a certain amount of liquor amnii, the lower uterine segment always to some extent sinks deeply into the small pelvis. The head in these cases finds no noteworthy resistance and the extent of its descent is measured by the amount of *vis a tergo*. This is more in primiparas and explains the entry of the head into the pelvis toward the end of pregnancy in these patients. In polyhydramnios the head remains high in primiparas as well as in multiparas and sinks only where a large amount of liquor is expelled and the stretching of the soft parts is sufficiently advanced. J. P. GREENHILL.

Harper, Carl S.: Management of Occipito-Posterior Positions. Wisconsin Medical Journal, 1924, xxiii, 23.

Careful and early diagnosis of all possible causes of delayed labor should be made, always keeping in mind, especially in a primipara, that posterior positions of the occiput are very common. Progress of labor should be closely followed with frequent "check ups" by the physician, and not left to untrained observers. Most "obstetrical wrecks" are occasioned by faulty, or entire lack of observation. In selected cases, manual rotation of the occiput above the pelvic brim is the method in occipito-posterior positions requiring interference. F. J. SOUBA.

Weinzierl: High Median Occiput Presentations. Zeitschrift für Geburtshülfe und Gynäkologie, 1923, lxxxvi, 221.

The author presents a study of 18 cases of high median occiput presentations in a series of 8800 labors occurring from 1912 to 1922 in the Prag Clinic. The cases were equally divided between the pos. occip. pub. and the pos. occip. sacr. The former position occurred twice as frequently in multiparae as in primiparae, the latter showed seven primiparae to two multiparae. Of the 18 cases only three, two of these pos. occip. sacr. were delivered spontaneously, all the others requiring operative measures. The author, therefore, concludes that this position is not merely a rare, but also a very serious complication of labor. There is probably no single etiology, but the condition is the result of a rare summation of various factors. Although there is a possibility of spontaneous labor, it is decidedly against the rule. For this reason, a very conservative attitude should not be maintained since the labors are always protracted, and the prognosis for both mother and child, but particularly for the mother, increases progressively in severity with the length of labor. Among the operative measures for delivery, the Kielland forceps used as a rotator should be particularly emphasized. MARGARET SCHULZE.

Haupt: The Cause of High Median Sagittal Presentation with Especial Consideration of Disproportion between Maternal Pelvis and Fetal Head. Zeitschrift für Geburtshülfe und Gynäkologie, 1923, lxxxvi, 459.

The occurrence of high median sagittal presentations is both relatively and absolutely more frequent in cases of disproportion than where there are normal relationships, whether this disproportion is due to contracted pelves of various types, or due to a large head, or to both. Aside from transversely contracted pelves, in which the etiology is clear, the forms of the pelvis whether generally contracted or flat, appear to play a rôle only insofar as the sacral position is more common in the former, the pubic in the latter. The previous or subsequent labors of the same woman are not necessarily all by the same mechanism. The back is not always primarily—nor even later—forward. In many, probably in most cases, the skull possibly because of peculiarities in its resistance is the direct cause of the presentation. MARGARET SCHULZE.

Rowland, J. A.: A Case of Unusual Malpresentation. The Indian Medical Gazette, 1923, lviii, 24.

The writer reports a case of a multipara, in labor at term more than twenty-four hours. Vaginal examination disclosed the head, a foot and a hand firmly impacted in the vagina, the head between the hand and foot. Patient was anesthetized but parts could not be replaced so head was perforated and arm removed at shoulder joint but still version could not be done. Head was severed from thorax by cutting with scissors. Head was then pushed back, uterus explored and child extracted. There was difficulty in extracting the head. After delivery a sessile submucous fibroid, the size of a large orange, was found in the upper segment of the uterus. The tumor was incompletely split in halves. Patient had had two normal deliveries previous to this confinement. Patient died about twenty-four hours later. F. J. SOUBA.

Stiglbauer, R.: The Treatment of Brow Presentations. Monatsschrift für Geburtshülfe und Gynäkologie, 1924, lxvi, 205.

Among 72,000 labors which occurred in the Second Woman's Clinic in Vienna during the last 22 years, there were 65 cases of brow presentation, i. e., one brow presentation to 1108 births. In only a few cases was the origin of this deflection attitude found but most of the babies were larger than normal. In almost one-half the cases there was some degree of pelvic contraction and 37 of the patients were multiparas. Of the 65 babies, 25 or 38.5 per cent were born spontaneously and 19 of these were born alive. Of the 40 children delivered by operative procedures 15 died. Among the operative procedures were version, cesarean section, forceps, hebosteotomy and craniotomy. The Kielland forceps proved especially valuable and the author believes these forceps will save many babies and make cesarean section in some of these cases unnecessary. J. P. GREENHILL.

Pfeiffer: The Management of Breech Presentation. New York Medical Journal, 1921, cxiii, 178.

As the inherent fetal mortality is far higher in breech than in head presentations, an attempt should always be made to correct this position. External version is more often more successful than is commonly supposed and may frequently be accomplished before labor or early in labor if the membranes are unruptured. The membranes often rupture at the onset of labor because the irregular breech does not fill the lower uterine segment as well as the globular head. It is therefore well to keep the patient in bed to preserve the membranes intact and to prevent

prolapsed cord if ruptured. Early interference is not only meddlesome but dangerous, as an incompletely dilated os is the most frequent cause of difficulty in extracting the head. Labor should be allowed to progress until the umbilicus is delivered unless positive indications for interference develop. The pelvic floor should be prepared by manual dilatation or a central episiotomy. Proper assistance is of great importance, so that head and arms may be kept well flexed and delivery accomplished by expression rather than traction. Cesarean section is never justified in breech presentation *per se* but only when other indications coexist.

MARGARET SCHULZE.

Abernethy: The Direct Shoulder Delivery of Müller. Zeitschrift für Geburtshülfe und Gynäkologie, 1924, lxxxvii, 36.

After a critical review of the literature and an analysis of his own statistics, the author concludes that the direct delivery of the shoulders by traction on the body in breech extractions, as described by Müller, gives better results than indirect delivery of the shoulders with release of the arms. He, therefore, recommends even in contracted pelves of the second degree that the child be delivered by direct traction so long as progress continues. MARGARET SCHULZE.

Rombach: Unsuspected Pregnancy. Nederlandsch Tijdschrift voor Geneeskunde, 1923, i, 276.

Since the question, whether a woman may be pregnant and even go into labor without being cognizant of her condition, has a medicolegal aspect, the author reports two cases which have some bearing on this question. Both were married primiparae, the one not expecting to be pregnant and the other, after four years of sterility, having given up all hopes of bearing children. While both experienced the usual amenorrhea, they paid no particular attention to it. One of the women wore her usual corset during the entire pregnancy and neither one complained very much of pain, even during the second stage. R. E. WOBUS.

Boursier and Gautret: Acute Polyhydramnios. Abdominal Puncture with Continuation of Pregnancy. Bulletin de la Société d'Obstetrique et de Gynécologie de Paris, 1923, xii, 389.

A patient whose previous pregnancies had been normal, showed in the eighth month of the present pregnancy a moderate degree of polyhydramnios. This anomaly however, rapidly increased and the patient experienced severe pains in the epigastrium and in the right flank and hypochondrium. There were no respiratory or circulatory disturbances but despite this it was decided to intervene. A puncture was made just below and to the right of the umbilicus and about 2 liters of clear amniotic fluid were slowly withdrawn, after which the uterus was soft and the fetal heart tones could be heard. The patient was given morphine and no uterine contractions were felt. After seven or eight days the fluid reaccumulated in the uterus and the pains recurred. The patient went into labor spontaneously 17 days after the abdominal puncture. Great difficulty was encountered in delivering the child, which weighed 4050 gm. The maternal blood Wassermann was negative. J. P. GREENHILL.

Luker, S. G.: The Dangers and Treatment of Prolonged Pregnancy. The Clinical Journal (London), 1922, li, 618.

A common cause of difficulty at delivery is the disproportion between fetal head and maternal pelvis due to allowing the pregnancy to be prolonged. The usual method of induction is an ounce of castor oil early in the morning of the expected

labor, a light breakfast is allowed afterward. Two hours later the patient is put in a sitz bath up to the waist, temperature between 105 and 110. Large soap and hot water enema given. Quinine sulphate grains x is now given and two hours later grains v, to be followed in two hours by a second dose of grains v. A tight binder is applied and the patient encouraged to move about. Labor usually comes on within a day. If castor oil fails, labor should be induced with bougies. No case should be allowed to go over seven days past the estimated date unless there exists a doubt as to the last period. All pregnancies are due 280 days from the first day of their last period. A. C. WILLIAMSON.

Vogt, E.: Characteristics of the Present Day Conception and Management of Retroflexion of the Pregnant Uterus. Klinische Wochenschrift, 1923, ii, 451.

The author believes that as a rule the retroflexion is primary and the pregnancy secondary. In the vast majority of cases, the retroflexion is corrected spontaneously as the pregnancy advances. In the Women's Clinic of Tübingen, in operating upon a large number of prolapse cases, usually associated with retroflexion, they have contented themselves with plastic repair, allowing the uterus to remain posterior. Subsequent pregnancies in these cases have gone to term without disturbance.

Even in cases of spontaneous correction, abortion may occur, on account of the damage to the endometrium through swelling and inflammatory changes before the correction takes place. This "nature healing" may be prevented by adhesions, by an infantile pouch of Douglas, by an abnormally prominent promontory, or even by fixation of the portio over the symphysis. In the author's opinion, however, the nonoccurrence of spontaneous correction is most probably due to atony and maldevelopment of the round ligaments and of the uterine musculature, and possibly also to an overdevelopment of connective tissue in the isthmus uteri, whereby its normal function as a sort of lever may be disturbed.

The symptomatology of this condition is characteristic, and depends almost entirely on the urinary bladder. In the third or fourth month of pregnancy dysuria develops and increases steadily; paradoxical ischuria is the rule; there is also pressure on the rectum, tenesmus, obstipation, and at times symptoms of ileus. The bladder is distended, occasionally reaching to the umbilicus or higher. Differential diagnosis from other pathologic pelvic conditions is not as a rule difficult, especially if one remembers the bladder symptoms.

The chief complication is urinary infection, with at times gangrene of the bladder mucosa; there may also be ileus, intestinal gangrene, infection of the uterus and its contents, peritonitis, rupture of the uterus, or even rupture of the posterior vaginal wall. In one case, the fundus protruded through the distended anus.

The preferred treatment is manual reposition under anesthesia (spinal or scopolamine-morphine), after emptying the bladder and the rectum. In gangrenous cystitis, if the catheter cannot be employed successfully in spite of irrigations, etc., the bladder must be opened widely by a vesicovaginal incision. If there is no gangrene, but catheterization fails, suprapubic puncture is to be made.

At times, colpeurysis may be employed as a preliminary to manual replacement. Occasionally, the distension of the vagina and the rectum by air (through the simple introduction of specula), will greatly facilitate the subsequent replacement. Posture, such as the knee-chest position, may help considerably.

Reposition is not to be attempted in the presence of gangrene of the bladder or of a markedly contracted pelvis. Here therapeutic abortion is strongly indicated, as well as in cases of inevitable abortion, infection, or poor general health. This procedure is carried out in the usual manner, or posterior vaginal section may be employed. Puncture of the uterus through the posterior vaginal wall,

and even symphysiotomy, have been recommended, but are condemned by the author.

If efforts at manual reposition fail, and there are no contra-indications, replacement by laparotomy is indicated, though Vogt has not so far had occasion to resort to it.

As a prophylactic measure, a retroverted uterus which is discovered in early pregnancy should be replaced by gentle bimanual manipulation and a pessary should be worn thereafter for five or six weeks. Furthermore, women who have been under treatment for retroflexion should be instructed to return for examination should they become pregnant, in order to ascertain whether the uterus is in normal position. E. L. KING.

Klots: A Case of Incarceration of the Pregnant Retroflexed Uterus with Rupture of the Bladder. Nederlandsch Tijdschrift voor Geneeskunde, 1924, i, 1942.

A Javanese woman aged thirty-five who began to menstruate and was married at 16, was pregnant for the third time. She had previously been delivered spontaneously of healthy children. For 5 days she complained of pain in the lower abdomen and inability to void. The bowels had not moved during this time, but flatus were freely expelled. Rhythmic contractions of a cystic tumor in the lower abdomen were interpreted as uterine contractions. On later examination, these contractions as well as the tumor had disappeared, without any change in the pain. The temperature remained normal, but pulse and breathing became accelerated. Catheterization yielded only 20 c.c. of thick bloody urine. Vaginal examination revealed the incarcerated pregnant uterus in the hollow of the sacrum.

The diagnosis of rupture of the bladder having been made, the abdomen was opened. Several liters of urine were free in the abdomen and the bladder showed a necrotic area with a bleeding point from which urine was issuing freely. This was sewed up and the necrotic area buried with Lembert sutures. After this, the uterus was brought forward. It was found that the coccyx had been bent at right angles, causing a groove in the posterior uterine wall. The coccyx, however, was easily bent downward, after which reposition was accomplished. Patient aborted next day, passing a macerated 4 month fetus. Recovery was surprisingly prompt and uneventful. R. E. WOBUS.

Küstner: The Bacteriology of the Separating Umbilical Cord under Various Methods of Treatment. Zeitschrift für Geburtshülfe und Gynäkologie, 1922, lxxxiv, 771.

The author reports bacteriologic observations upon two series of newborn children in which the umbilical cord was treated in radically different manner. In the first series of 120 children, the navel was covered with dry sterile dressings changed every 48 hours, and the child was not bathed until after the cord had separated and the umbilicus healed, usually in eight to ten days. In the other series of 80 cases, the child was bathed daily and the dressing renewed after the bath. In this series, the cord usually separated earlier, on the fifth to seventh day, but the small wound left ordinarily did not heal for several days more. Culture material obtained from the depths of the navel was placed on Loeffler's serum and ascites agar.

In the unbathed children, the ordinary skin organisms were most frequently found. The coli group, the staphylococcus albus, diphtheroids, and harmless parasites comprised 72.4 per cent of the cases. The remaining 27.6 per cent were organisms which probably always possess sufficient virulence to form a menace to the child: staphylococcus aureus, the hemolytic staphylococcus albus and the streptococcus. Sixty of the 120 children showed some type of pathogenic organism on at

least one examination, but usually its presence was only transient. In a few cases showing definite evidence of infection, the pathogenic organisms were constantly present on repeated examination in spite of careful treatment. Since therapy apparently accomplishes so little, the necessity for careful asepsis is even more apparent. The type of delivery, even including cesarean section, had no apparent influence on the bacterial flora, nor did the bath for resuscitation in the asphyxiated cases.

The children bathed daily, however, showed markedly different results. Here only 49.5 per cent showed nonpathogenic, while 50.5 per cent showed pathogenic organisms on at least one occasion.

The author concludes from these observations that it is best not to give infants a complete bath until the umbilicus has healed. MARGARET SCHULZE.

Gilfrich: Rupture of the Umbilical Cord Vessels during Labor. Zeitschrift für Geburtshülfe und Gynäkologie, 1923, lxxxvi, 633.

The author discusses the literature of this condition and cites several cases of his own. He believes that it occurs far more frequently than is reported. Rupture of the entire cord is fairly common, rupture of isolated vessels far less frequent. The most common etiology is the occurrence of vasa previa in the velamentous insertion of the cord. Vasa aberrantia if situated near the os may rupture. Anomalies of the vessel walls, as varices, may be a factor. A too short cord, or tension due to looping of the cord about the neck or an extremity, may be predisposing factors, and operative manipulations may be a direct cause of injury.

The author collects 32 cases of rupture of vessels in velamentous insertion. The accident is rather rare. The prognosis for the child is extremely bad since 24 of the 52 children died. Seven of the cases occurred in twin pregnancies; in only two of these did the children live. In a few cases, the diagnosis of vasa previa was made by feeling a cord-like pulsating thickening in the membranes stretching across the internal os. Usually hemorrhage with rupture of the membranes gives the first hint of the condition. Two cases of vasa aberrantia gave similar symptoms.

Varices of the vein walls may lead to the formation of hematomas in Wharton's jelly, external bleeding after the formation of a hematoma, or free external bleeding without the formation of a hematoma. The hematomata often form considerable tumors, as large as 5 cm. in diameter. The condition is of considerable danger to the child.

Rupture of a vessel by external trauma as on freeing a tight loop of cord or by obstetrical instruments is of much less danger, since the child is already or soon delivered and the lesion may be competently dealt with. MARGARET SCHULZE.

Häggström, P.: Prolapse of the Umbilical Cord. Acta Gynecologica Scandinavica, 1924, ii, 517.

From 1900 to 1923 there were 71 cases of prolapse of the cord among 13,907 cases of childbirth, an incidence of 0.51 per cent. This agrees fairly well with Nordlund's estimate of 0.65 per cent, which was the average of the reports of 10 different authors. Among the 71 cases reported by the author there were five times as many multiparas as primiparas and the accident occurred proportionately three to four times more commonly after forty years of age than before. The pelvis was contracted in 24 per cent of the patients. There were 10 twins and in 7 of these the cord which prolapsed was that of the second child. Polyhydramnios and placenta previa each occurred four times and prolapse of an arm 9 times in the series. Many of the babies were either very large or very small.

In only 66 per cent of the cases was there a head presentation. The average

length of the cord was well over 70 cm. There was no maternal death but a fetal mortality of 36.6 per cent. The children of primiparas had a much higher mortality. The prognosis for twins, however, is very good since only one baby died out of ten twins. In 12 cases where delivery was spontaneous 8 babies died. In only 4 cases was the cord successfully replaced but one of these babies died. Seven of nine children delivered by forceps lived. After version and extraction 15 out of 20 children lived, while breech extraction yielded 13 live babies out of 14. On one patient a vaginal and on another an abdominal cesarean section were performed, both babies being born alive. J. P. GREENHILL.

Bermann: Prolapse of the Cord. Gynécologie et Obstetrique, 1920, ii, 347.

The author gives the histories of seven cases of prolapsed cord in which a live child was extracted after the cessation of funicular pulsation.

His study of these cases and others in literature leads him to draw the following conclusions. (1) Absence of pulsation in a prolapsed cord, even in the absence of fetal heart sounds, is not proof that the child is dead. (2) In the above contingencies, if dilatation is sufficient, one should introduce the hand and observe by palpation of the precordial region whether or not the fetal heart is beating. (3) Even if no heart beat is evident, if it is possible, one should extract the child and not consider embryotomy until one hour has elapsed after all signs of life have been absent. (4) The chance of life depends upon the degree and length of time of compression, rapidity of extraction, and proper employment of all means of resuscitation. R. T. LAVAKE.

Zangemeister: Manual Replacement of Prolapsed Cord. Muenchener Medizinische Wochenschrift, 1920, lxvii, 1375.

The author is forced by contemporary criticism into a defense exposition of his stand regarding the relative merits of manual replacement of the prolapsed umbilical cord. He objects to the common practice of employing manual replacement only when version and breech extraction are absolutely contraindicated.

He holds the indications for manual replacement to be: (1) Where rapid spontaneous delivery is assured after replacement of cord; (2) Where version and breech extraction is especially difficult (nulliparae), or fraught with danger.

Manual replacement is contraindicated: (1) With dead fetus; (2) With marked injury to fetus; (3) In case of cord appearing outside of vulva; (4) When the intensity of the pains, or relative disproportion between fetal head and pelvis, or the position indicate delayed delivery.

Face presentation or prolapse of an arm are not contraindications to manual replacement of cord. With incomplete dilatation (permitting the hand but not the fetus to pass) manual replacement is especially indicated. When the dilatation does not permit of manual replacement, when the birth canal is not contaminated, and when the child is at term or clearly viable, abdominal or vaginal caesarean section must be considered. S. B. SOLHAUG.

Pettersson, A. S.: Complete Circular Detachment of the Portio Vaginalis during Labor. Monatsschrift für Geburtshülfe und Gynäkologie, 1923, lxiii, 315.

The author reports the case of a 38-year-old primipara who was delivered with forceps after a labor which lasted four days. Following delivery there was no undue bleeding but the portio vaginalis of the cervix was found on the baby's head. In 12 similar cases collected from the literature 75 per cent were primiparas and most were old primiparas. In all the cases the head presented and the pains were very strong. In only 4 of the 12 cases did labor end spontaneously

and in no case was there an unusual amount of bleeding. In most of the cases the external os had been unyielding despite strong uterine contractions. Wallich believes this condition is secondary to a serobloody infiltration which is due to a disturbance in the circulation from mechanical obstruction. Couvelaire believes the rigidity is due to an acute inflammation which also explains the serobloody infiltration emphasized by Wallich. The inflammation brings about a deficiency in elastic fibers.

While in some cases the instrument detached the cervical cuff, in others the latter was expelled spontaneously. All but three of the 12 cases recovered. One patient died of carcinoma of the portio, one of septic arthritis and the third of peritonitis. The prognosis for the babies is bad as only two were born alive. Of 6 patients examined some time after delivery 5 had an imitation portio with an opening in the middle.

J. P. GREENHILL.

Fueth, H.: An Unique Injury of the Vaginal Portion of the Cervix during Delivery (Spontaneous Ring-Shaped Separation of a Large Flap). Archiv für Gynäkologie, 1923, cxix, 119.

The patient was a primipara with a slightly contracted pelvis, premature rupture of the membranes, long cervix, short vagina and strong labor pains. During labor the cervix felt spongy and before the head was delivered, a large ring-shaped portion of the cervix was extruded. The cervix now felt absolutely normal as though nothing had occurred. The author discusses 3 other cases found in the literature and the etiology of this condition, as advanced by Schauta. The latter believes that the eccentric location of the os in primiparae during the first stage of labor and the pressure of the descending head causes the necrosis. There is practically no danger of hemorrhage, the only danger being infection or necrosis of the stump. The treatment consists in the removal of the detached portion.

RALPH A. REIS.

Benthin: The Etiology of Suppuration of the Symphysis. Monatsschrift für Geburtshülfe und Gynäkologie, 1922, lviii, 141.

The author reports the case of a quintipara who had had four spontaneous labors and whose fifth labor terminated spontaneously after the use of pituitrin. The baby, unlike the others, was small. Twenty-four hours later the patient complained of severe pain in the abdomen which radiated down the legs. She experienced a sensation that something had burst in the abdomen. She fainted and on awakening found she had incontinence of urine. The latter continued during the next day, as did the pain, which had localized in the pelvic bones. On the fourth day control of the urine reestablished. On the tenth day there was an elevation of temperature and a swelling appeared over the symphysis. The patient was not brought to the clinic until one month postpartum. The tumor which seemed to arise from under the pubis, at this time extended up to within two fingers' breadth of the umbilicus. The symphysis was exquisitely tender and internal examination revealed normal genitalia. Examination of the urine was negative. Puncture of the swelling revealed pus and blood, and bacteriologically nonhemolytic streptococci were found. The x-ray showed the pubic bones widely separated. An incision was made and a large amount of pus liberated. Convalescence was rapid but the gait was a waddling one and the separation of the symphysis while less than formerly was still present. Four weeks later the symphysis had united, but pressure still elicited pain and the gait was uncertain.

There are two possible explanations for the suppuration of the symphysis in this case, first, that there was a rupture of the symphysis after which a hema-

toma formed and this was secondarily infected. Secondly, there was a hematoma which became infected and produced a separation of the symphysis. The author believes the origin to be a spontaneous rupture of the symphysis occurring postpartum. He bases his belief on the bladder disturbances, the patient's sensation of rupture in the puerperium, pain in the pelvic bones on motion and the fact that fever did not occur until late. J. P. GREENHILL.

Koerting: The Question of Air and Gas Embolism during Labor. Zentralblatt für Gynäkologie, 1923, xlvii, 1657.

The writer discusses the reported cases of air embolism and arrives at the conclusion that in practically every case the condition really may be attributed to a "gas bacillus" infection. He reviews extensively the literature of this infection. LITTLE.

Whitman: Obstetrical Paralysis of the Peroneal Nerve. Surgery, Gynecology and Obstetrics, 1922, xxxiv, 32.

Paralysis of the peroneal nerve from pressure on the main trunk of the sciatic nerve, in its intrapelvic portion, is a comparatively rare condition. It occurs during prolonged labor, either from direct pressure from a large head in a small pelvis, or from trauma by application of forceps. It may have occurred in a larger number of cases than have been reported. In cases of paralysis occurring below the knee after prolonged or difficult labors, Whitman advises an immediate orthopedic and neurologic examination in order to arrive at a definite diagnosis. Apparatus should be applied immediately to prevent deformity and to enable the patient to get around with the maximum facility. The prognosis as to ultimate recovery should be exceedingly guarded. R. E. WOBUS.

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